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Important Books Received

Third Report of the Commission on Medical Education. Willard C. Rappleye, M.D., Secretary. 1928: pp. 70; 7¼ x 4 in.; no illustrations. Published by the Commission, 215 Whitney Avenue, New Haven, Conn.

American illustrated medical dictionary. By W. A. Newman Dorland, A.M., M.D., F.A.C.S., member of the Committee on Nomenclature and Classification of Diseases, American Medical Association, and Editor of the "American Pocket Medical Dictionary;" with the collaboration of E. C. L. Miller, M.D., Professor of Bacteriology and Biochemistry, Medical College of Virginia. *Fourteenth edition.* 1927: pp. 1388; 8¼ x 4¾ in.; 319 illustrations; flexible binding—plain, $7.00; thumb index, $7.50. W. B. Saunders Company, Philadelphia and London.

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INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

SCIENTIFIC PROCEEDINGS OF THE CHICAGO SECTION[1]
OCTOBER 16, 1928

B. ORBAN, M.D., *Editor*

Meeting held at the West Side Student Y. M. C. A. Building, Chicago, October 16, 1928. Chairman: B. Orban, M.D., Secretary of the Section.

Scientific program

I. Findings in early tooth development and eruption. *W. G. Skillen*, D.D.S., and *Emil Mueller*, M.S., D.D.S. 613
II. Heterotopic ossification in the pulp. *E. D. Coolidge*, D.D.S., B.S., F.A.C.D. 613
III. Biologic relationship between epithelium and dentin. *B. Orban*, M.D. 614
IV. The dento-enamel junction. *S. D. Tylman*, B.S., D.D.S. 614
V. Wandering of teeth. *J. R. Schumaker*, D.D.S. 614
VI. An interesting root-canal case-report. *J. F. Svoboda*, Dental student 614

ABSTRACTS

I. FINDINGS IN EARLY TOOTH DEVELOPMENT AND ERUPTION

W. G. Skillen, D.D.S., and Emil Mueller, M.S., D.D.S., Northwestern University Dental School

A lecture illustrated with slides. The authors demonstrated the development of the lip furrow from the lip-furrow band. It is interesting to observe the loop-like lip-furrow band in the new-born rat. The later separation of the lip from the gingiva is preceded by extensive hornification, which can also be seen over the lips of erupting incisors of rats, and a similar process could be shown preceding the crevice formation. This is of particular interest because Gottlieb described a condition of this nature as early as 1921. He called this a "preparation of the tissue for eruption of the tooth."

II. HETEROTOPIC OSSIFICATION IN THE PULP

E. D. Coolidge, D.D.S., B.S., F.A.C.D., Chicago College of Dental Surgery, Dental Department of Loyola University

A unique case of bone formation in the pulp of a rat incisor has been

[1] The last preceding series of abstracts of the proceedings of the Chicago Section was published in the *Journal of Dental Research*: 1928, viii, p. 7.

demonstrated. This case illustrated probable metaplasia of the pulp. The development of the bone in this case is described as follows: Increase in the fibrous intercellular substance first takes place, followed by hyalin degeneration. The degenerated tissue subsequently calcifies and becomes bone.

III. BIOLOGIC RELATIONSHIP BETWEEN EPITHELIUM AND DENTIN

B. Orban, M.D., Chicago College of Dental Surgery, Dental Department of Loyola University

It is known that no dentin can be built without the presence of epithelial cells, which probably activate the pulp cells to deposit dentin. The speaker demonstrated microphotographs upon which he based his conclusion that, in the building of the denticles and occasionally of secondary dentin, the epithelial rests play a great part.

IV. THE DENTO-ENAMEL JUNCTION[2]

S. D. Tylman, B.S., D.D.S., University of Illinois College of Dentistry

The question of the origin of the scallop-like dento-enamel junction is widely discussed. The essayist demonstrated an unusual finding, which showed that the theory of resorption of the dentin by the ganoblasts is false. He contradicted Walkhoff's theory and favors Orban's views.

V. WANDERING OF TEETH

J. R. Schumaker, D.D.S., Northwestern University Dental School

The wandering of the dog's teeth has been shown. The distribution of the bundle-bone and resorption of the lamellated bone was shown in relationship to this movement. The findings harmonize with those described by Stein-Weinman in humans.

VI. AN INTERESTING ROOT-CANAL CASE-REPORT

J. F. Svoboda, Student, Chicago College of Dental Surgery, Dental Department of Loyola University

The author reported a case where a root-canal treatment had been made some years previously. X-ray findings were negative, but the patient developed an arthritic condition of the shoulder. The tooth was removed, and the patient was apparently relieved of the trouble. Histologic sectioning of the root disclosed a granuloma with epithelium.

[2] See Tylman: This issue of the *Journal of Dental Research*, page 615.

THE DENTO-ENAMEL JUNCTION[1]

STANLEY D. TYLMAN, B.S., D.D.S.

University of Illinois, College of Dentistry, Chicago, Ill.

We find, in a section through the dento-enamel junction, a wave-like or scallop-like union between the two tissues. In three dimensions, the dento-enamel junction presents a surface of dentin covered with minute craters into which the dome-like enamel knobs fit. So much is agreed upon by histologists. The manner in which this relation is established between dentin and enamel is still a matter of controversy. Certain groups are of the opinion that the scallop-like depressions in the dentin are the result of resorption in this tissue, following which the enamel is deposited therein; another group claims that the evidence for such an opinion is lacking, and point out certain reasons for a different view, namely, that the dentin is initially laid down in scallop-like formation, following which the ameloblasts, also called ganoblasts, deposit the enamel.

Ebner, and especially Walkhoff, have advanced the opinion that the resorption of the dentin is accomplished by the ganoblasts, or possibly by the newly built matrix of the enamel. They base their conclusions on the presence of enamel spindles in the enamel, which to all appearances consists of a dentinal matrix containing dentinal fibers. They further point to the similarity between these depressions in dentin and so-called Howships lacunae, present during resorption in bone. It was therefore concluded that at one time during the formative period the dentin occupied some of the space at the dento-enamel junction now containing enamel.

The other side of this controversy, chiefly represented by Orban, advance reasons that appear more acceptable. In the first place, in order to produce resorption, it is necessary to have a connective tis-

[1] From the Research Department (Director B. Orban) of the Chicago College of Dental Surgery, Dental Department of Loyola University. Read at a meeting of the Chicago Section of the International Association for Dental Research, October 16, 1928.

sue, which alone has the power to resorb. As the enamel-forming cells are of epithelial origin, it is doubtful that they could resorb dentin. Secondly, these cells are present for a highly specialized function, that of laying down enamel, and it is highly improbable that they would also have the function of resorption. The third reason for

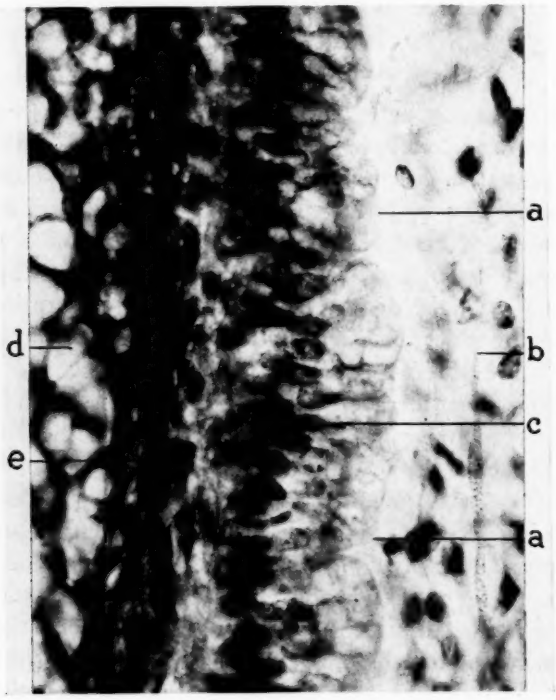

FIG. 1. Wavy contour (*a*) of the junction of the ganoblasts (*c*) and odontoblasts (*b*). This line later becomes the dento-enamel junction. *d*—Stellate reticulum; *e*—stratum intermedium.

believing that no resorption takes place is the microscopic finding of the scallop-like line between the odontoblasts and the ganoblasts, prior to the deposition of the dentin, as shown by Orban in his book on dental histology (*fig. 1*).

Finally, if resorption took place in the dentin prior to enamel depo-

sition, we might expect evidence of such resorption in the dentin at the dento-enamel junction. *Fig. 2* shows the dento-enamel junction in the coronal portion of an upper central incisor. You will observe the definite outline of the collagenous matrix of the dentin extending beyond the fibers. The characteristic scallop- or crater-like formation is present. Under a higher magnification (*fig. 3*), we see the terminations of the dentinal fibers. These end in profuse branchings and anastomoses. These branchings are continuous along the entire border, and beyond them is the amorphous border of the matrix.

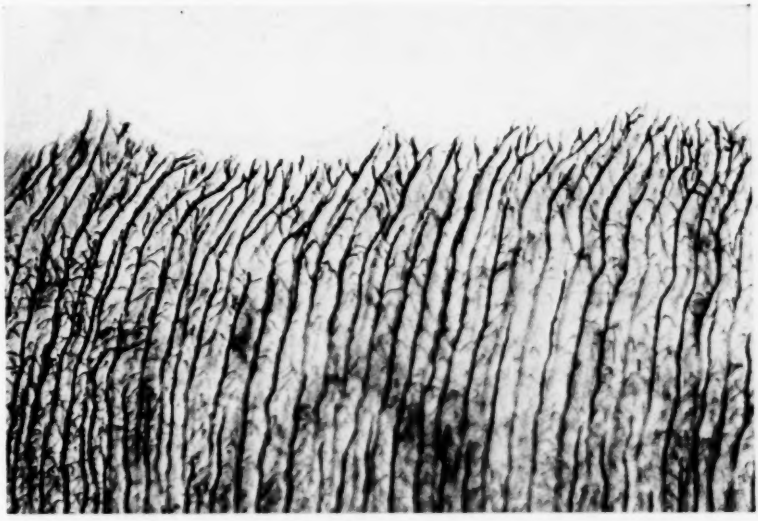

FIG. 2. Dento-enamel junction. Enamel lost by decalcification. Note profuse branching of the dentinal fibers at the borderline of the dentin (× 360). *See fig. 3.*

Fig. 4, taken from the same specimen and under the same magnification as the last one, shows an area where resorption has taken place in the dentin. A similar scallop-like border is evident in the dentin, the same as at the dento-enamel junction. You will observe, however, a difference in the terminal endings of the dentinal tubules. Whereas in the normal dento-enamel junction we have profuse branchings, in this case we find the tubules cut off abruptly. Would it not be reasonable to suppose that a similar condition would exist in a

normal dento-enamel junction, if the scallop-like formation were the result of resorption?

Fig. 5 originates from the same specimen and shows resorption in dentin. Here some of the dentinal fibers remained unresorbed, and are embedded in bone-like substance deposited after the resorption of the dentin ceased. This condition may be compared to that at the

FIG. 3. Higher magnification of *fig. 2* (× 830). The dentinal tubuli terminate in fine ends. *See fig.* 4.

dento-enamel junction. If the enamel spindles are the result of the remnants of unresorbed dentinal substance, we might expect a similar formation in the specimen shown here. However, we see only single dentinal fibers remaining between the bone corpuscles. W. Meyer has shown similar findings. A higher magnification (*fig. 6*) shows the structures more clearly.

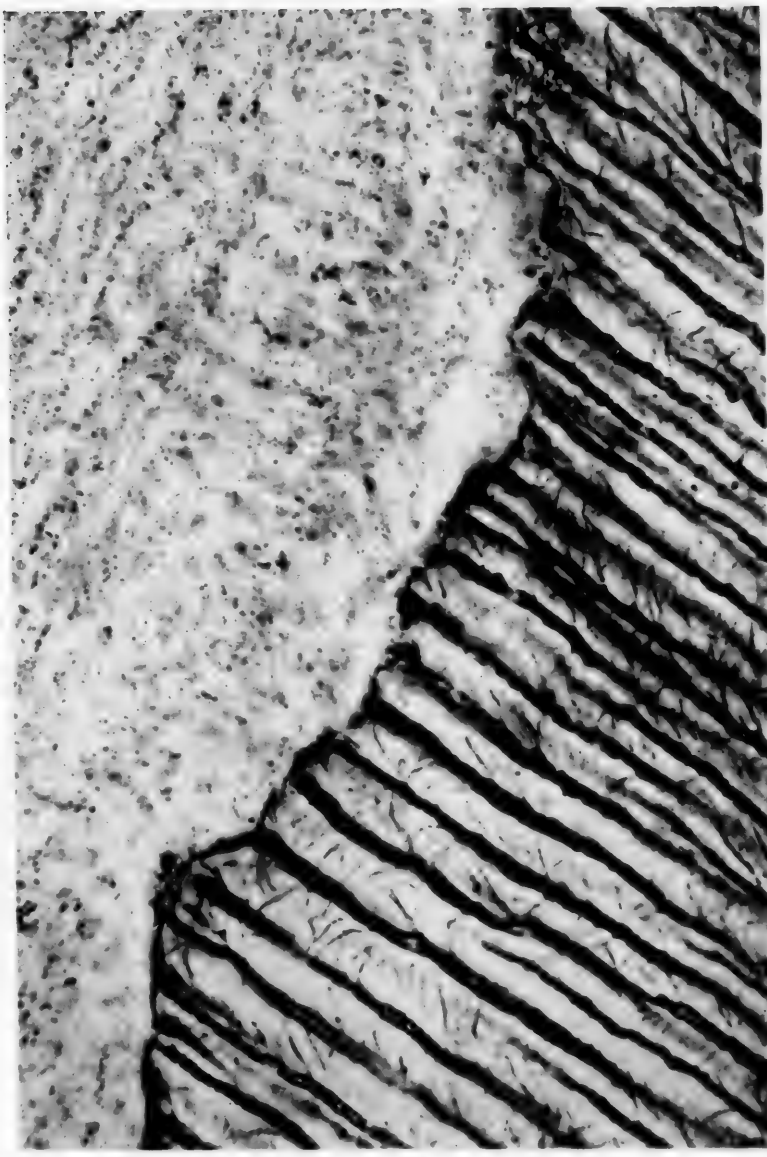

FIG. 4. Dentin showing resorption on surface (× 830). Compare with *fig. 3.* The dentinal tubuli are cut off sharply with no terminal branchings.

FIG. 5. Dentin resorbed and bone deposited on surface. Single dentinal fibers remained unresorbed and are embedded in bone (× 420). *See fig. 6.*

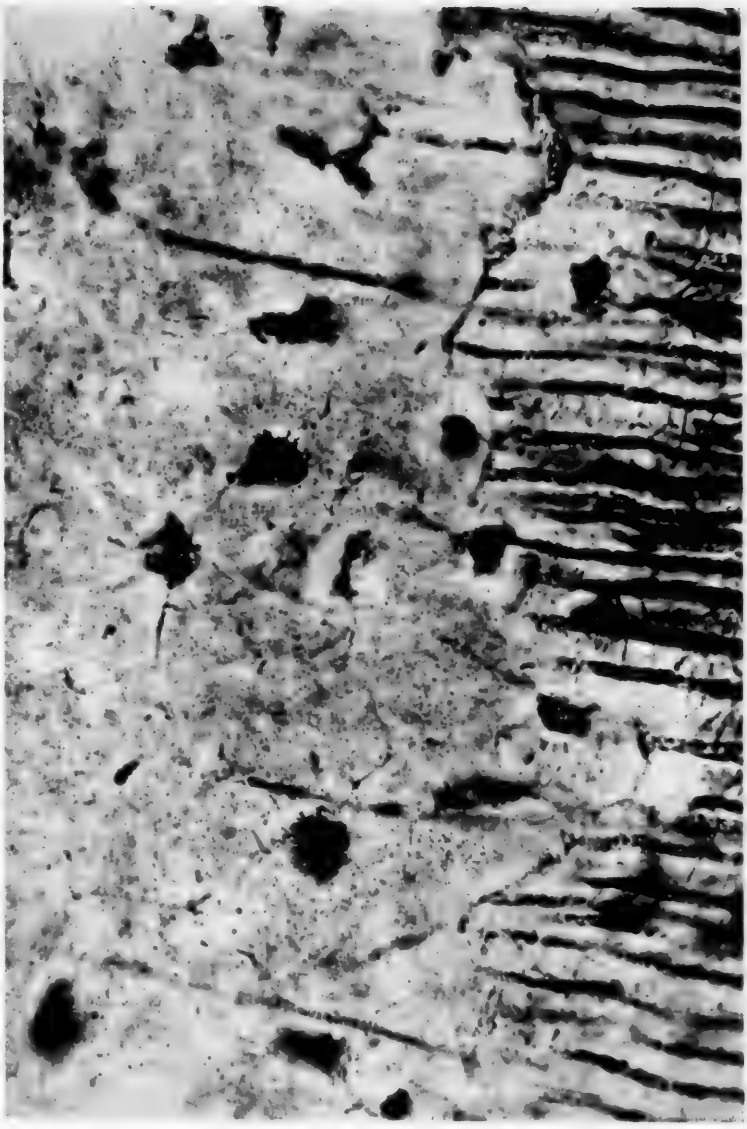

FIG. 6. A higher magnification of *fig. 5*, showing the relationship between bone and dentin (×830).

Upon these evidences we are inclined toward the view of those histologists who hold that the morphology of the dento-enamel junction is not the result of resorption, but due to the original relations of the odontoblasts and the ganoblasts.

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A TEAR IN THE CEMENTUM[1]

WILLIAM A. FIGG

Chicago, Illinois

On examining serial sections from the jaw of an old monkey, we found a specimen which may be of interest. It is a tear in the cementum on the lingual surface of one of the upper incisors. The tooth has been worn down, and large masses of secondary dentin have been deposited in the pulp chamber. On the lingual surface (*fig. 1*) we see, not far from the margin of the alveolar process, a long piece of bone-like substance in the soft tissue opposite the tooth. This piece of bone-like substance is surrounded by connective tissue, and is separated by it from the surface of the tooth as well as from the bone. This connective tissue is the periodontal membrane. By examining the specimen it was not difficult to settle the questions about the origin of this piece of bone-like substance. The high magnification showed it to be a piece of cementum that had been separated from the tooth in the earlier life of the monkey. We believe this tear occurred by means of a blow that moved the tooth in its socket, the cementum being torn, and the separated piece deflected into the periodontal membrane. The space between the tooth and the alveolar bone is about three times wider in the area where this piece of cementum lies than in other places. Under this cementum splinter, nearer to the apex, the periodontal membrane is of normal width. When we compared the width of the normal periodontal membrane with the space between the tooth surface and the cementum splinter, we found that the latter space was of the same width as the normal periodontal membrane.

Figure 2 shows the surface of the tooth, the cementum splinter, and the periodontal membrane. The study of this case gives some very

[1] From the Research Department (Director B. Orban) of the Chicago College of Dental Surgery, Dental Department of Loyola University. Read at a meeting of the Chicago Section of the International Association for Dental Research, May 25, 1928.

FIG. 1. A TEAR IN THE CEMENTUM ON THE LINGUAL SURFACE OF AN UPPER INCISOR OF AN OLD MONKEY

a—dentin; *b*—new deposition of cementum on root—secondary type; *c*—repaired resorption on surface of root; *d*—free margin of the gum; *e*—deposition of new cementum on surface of cementum splinter—secondary type; *f*—alveolar bone.

FIG. 2. ENLARGEMENT OF THE CEMENTUM SPLINTER (e) IN *fig. 1*

a—dentin; *b*—original primary cementum left on surface of the tooth; *c*—artificial space between new cementum and old cementum; *d*—new cementum on surface of root; *e*—new cementum on surface of cementum splinter; *f*—cementum splinter; *g*—alveolar bone; *h*—new cementum on surface of cementum splinter—primary type.

interesting data in dental histology. In two papers by foreign colleagues, published almost simultaneously, cases of tears in the cementum were described. One of them was written by H. Euler; the other, by W. Bauer. Both describe different cases of tears in the cementum, and both describe cases similar to the one under discussion. However, our case shows findings different in some respects from the others and may throw light on disputed questions. This photomicrograph (*fig. 2*) shows that the tear in the cementum did not occur at the junction of the cementum with the dentin, as described in all cases by Bauer and in some cases by Euler. Euler described also a case in which not only cementum but also a piece of dentin had been torn out with the cementum. The tear in our specimen occurred in such a way that a part of the old cementum remained in connection with the dentin, the outer part of the cementum having been torn away. The inner layer of cementum that remained in connection is seen in *fig. 2* at *b;* the cementum splinter, at *f*. This observation, that the tear occurred in the cementum, should be emphasized because of the fact that Bauer used his findings to support the statement that the cementum is merely deposited on the surface of the dentin, and not "grown together" with it. He states that there are no fibers running from the dentin into the cementum, or from the cementum into the dentin, but that the cementum is simply "deposited" on the surface of the dentin. However, the observation of Bauer is no proof against an organic connection.

It must be stated that no real proof has been furnished until now to show whether or not there is some fibrous connection between dentin and cementum. Many investigators have occupied themselves with this problem, but their conclusions are not similar. A few of the many publications will be mentioned here. Among the authors who believe that this connection is always present are Box and Fish. Box describes sections that show channels in connection with both the Tomes granular layer and the cementum lacunae. Fish demonstrated a lymphatic circulation between dentin and cementum. Noyes in his text-book is doubtful as to the probability of this connection, but in view of evidence presented by other authors does not state that there is none. Skillen and Thomas in their article say, in reference to the location and course of the granular layer: "It usually

FIG. 3. A HIGHER MAGNIFICATION OF A PORTION OF THE CEMENTUM SPLINTER; SEE *figs. 1 and 2*

a—periodontal membrane; *b*—new cementum on surface of secondary cementum; *c*—secondary cementum on surface of cementum splinter; *d*—new cementum on surface of cementum splinter—primary type; *e*—repaired resorption in cementum splinter; *f*—stretched connective tissue fibers of periodontal membrane.

begins weakly but increases varyingly in width as it proceeds apically, where it usually widens until it mingles with the cemental lacunae, forming a chaos of structural elements at the apical extremity." Rickert agrees with them that there is a connection in the apical third; whereas Endelman, Cahn, and Bödecker are of the opinion that, although a connection does not always exist, it is not a rare occurrence. J. A. Marshall believes that there is no connection. G. V. Black made these statements: "The cementum so far as has been demonstrated, receives no sustenance whatever through the dentin. . . . . Cementum is dependent on the periodontal membrane for the maintenance of the life of the cement corpuscles. . . . . When stripped of its peridental membrane, it becomes a dead tissue, no matter if the pulp of the tooth is alive." This leads one to believe that he was also of the opinion that no connection exists. As we can see from the foregoing references, this subject is still open for investigation.

We observe in our case the tear running in the cementum itself. Therefore it seems that the connection between dentin and cementum, at least in this case, is greater than it is between the lamellae of the cementum itself. We know that these are surely in organic connection with each other. Not only does this seem to cast a shadow of doubt on Bauer's statement, but Euler, as previously mentioned, has already described cases where not only the cementum but also a part of the dentin had been torn away in connection with the cementum. Both findings, Euler's and ours, show that there is often a very strong connection between the cementum and the dentin. However, we should not use these facts as proof either for or against an organic fibrous connection. The proof of a connection between dentin and cementum must be given a more thorough investigation, and can hardly be solved incidentally. In *fig. 2* we see that, on the surface of the cementum left on the dentin, new cementum of the so-called secondary type was deposited. It is certain that immediately after the tear occurred, no periodontal membrane existed, but blood and destroyed tissue occupied the space between the splinter of cementum and the surface of the tooth. Some time later, an organization of this wound took place, new cementum being deposited on the surface of the old cementum as well as on the surface of the cementum splinter.

By this new deposition of cementum, connective tissue fibers became embedded in the surface of the tooth as well as in the splinter of cementum. We see a thick layer of secondary cementum deposited on the surface of the tooth and on the tooth side of the splinter of cementum. New cementum is also deposited on the outer surface of the cementum splinter. This is of the primary type. It may be observed that the cementum splinter is in functional connection with the tooth on one side, and with the bone on the other. This connection is indicated by the stretched connective tissue fibers. We can compare this cementum splinter to the patella, being suspended on both sides by tendons. This piece of cementum acts for the tooth as alveolar bone.

The next microphotograph (*fig. 3*) is a higher magnification of the cementum splinter. At *d* we see the primary cementum and the fibers embedded in it. On the opposite side we may observe the fibers at *a* embedded in secondary cementum. A resorption which was repaired may be seen in the middle of the picture (*e*).

In *fig. 4* we see that the primary cementum still left on the tooth was partially resorbed in some places, and at one place was completely resorbed along with part of the dentin. At the point where the cementum and part of the dentin were resorbed, secondary cementum was laid down with a firmer connection than anywhere else on the surface of the primary cementum in the area of the tear. This may be concluded from the fact that, during the preparation of these sections, a tear occurred at most places where secondary cementum was deposited on the primary cementum from which the outer part had been torn away. Over this secondary cementum can be seen a layer of primary cementum that is continuous with the original untorn primary cementum (*fig. 4, f*).

Figure 5 is a photograph of one of the last sections in the series. Only the most apical extremity of the cementum splinter can be seen. It is entirely surrounded by bone and connected to this bone by a periodontal membrane, which on the lingual surface seems to be the original periodontal membane attaching the tooth to the bone. Our reason for so believing is based on the fact that epithelial rests can be seen on this side of the cementum splinter. Euler also reported similar cases.

FIG. 4. ENLARGEMENT OF PART *c* OF *fig 1*, SHOWING REPAIRED RESORPTION ON THE SURFACE OF THE ROOT

a—space between cementum left on tooth and secondary cementum; *b*—dentin; *c*—cementum left on surface of tooth; *d*—repaired resorption; *e*—periodontal membrane; *f*—new cementum.

There came under our observation another case, that of a human forty-five years old. This tooth, a lower central incisor, shows tears

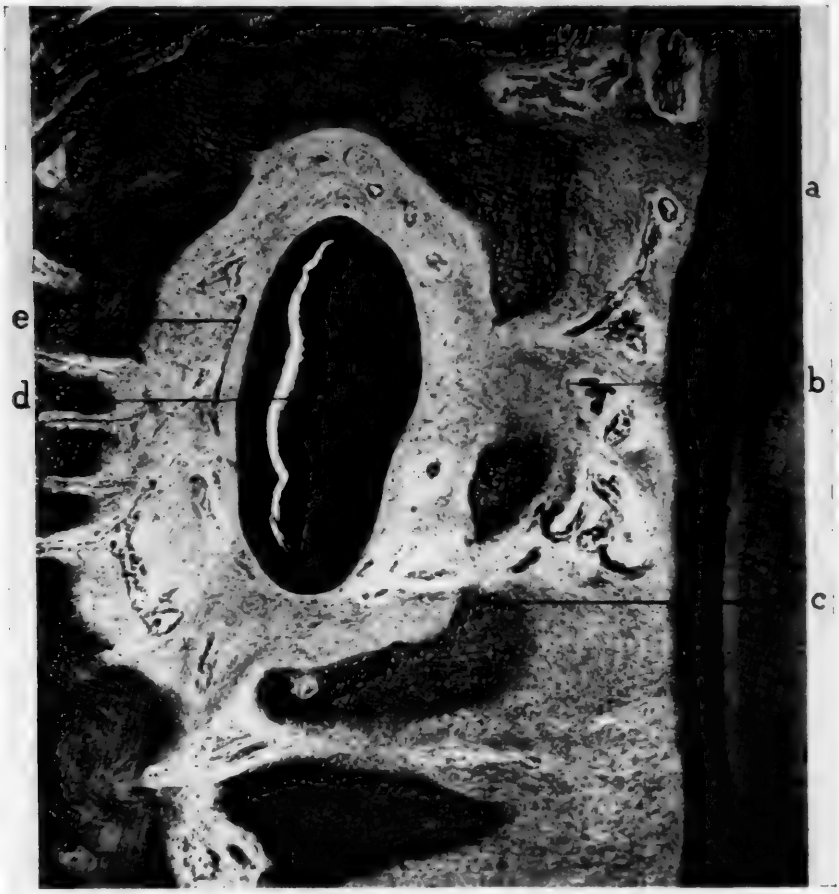

FIG. 5. SHOWING THE APICAL EXTREMITY OF THE CEMENTUM SPLINTER (*e, fig. 1*) ENTIRELY SURROUNDED BY BONE

a—dentin; *b*—periodontal membrane; *c*—alveolar bone; *d*—cementum splinter; *e*—epithelial rests.

in several places on the surface of the root (*fig. 6*). The root also was fractured at the apex, and interesting facts in this connection will be

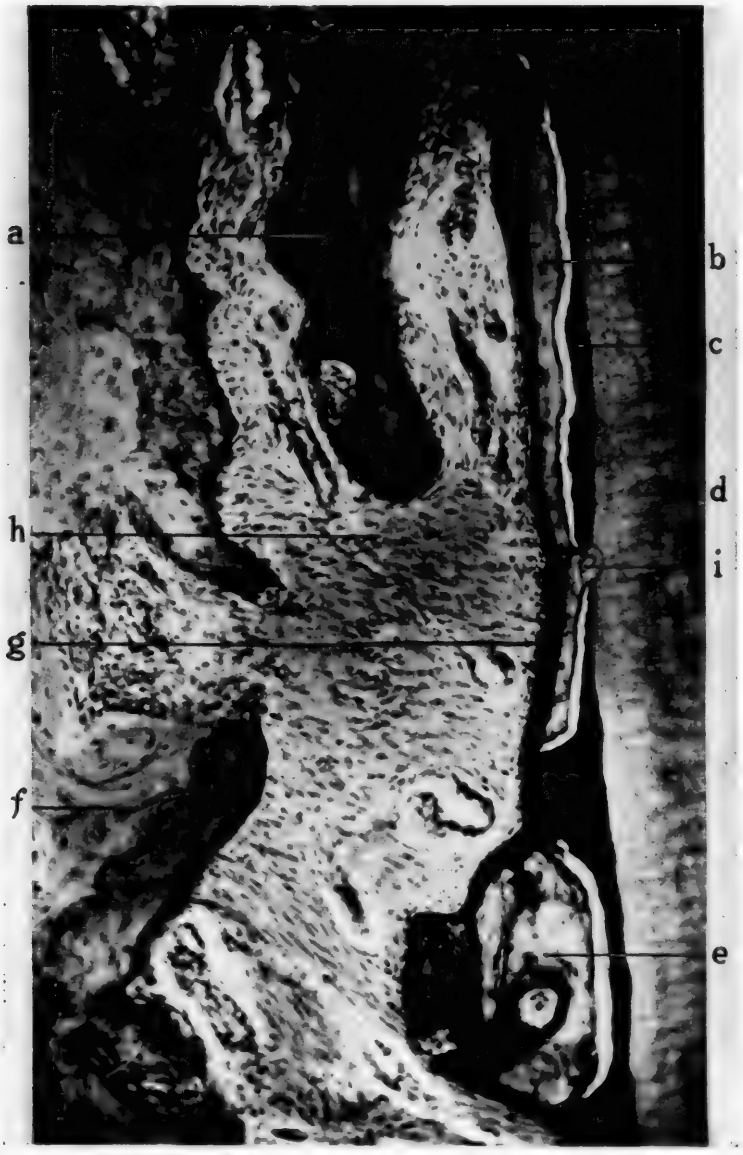

FIG. 6. HUMAN LOWER CENTRAL INCISOR SHOWING TEARS IN SEVERAL PLACES ON THE SURFACE OF THE ROOT.

a—cementum splinter; *b*—new cementum on surface of tooth; *c*—old cementum; *d*—dentin; *e*—another cementum splinter; *f*—alveolar bone; *g*—new cementum of primary type; *h*—periodontal membrane; *i*—repaired resorption.

reported in another place from our department. A splinter of cementum torn away from the tooth may be seen at *a*. The tear that occurred in this specimen is similar to the first one under discussion; that is, it occurred in the body of the cementum and not at the cemento-dentinal junction. Secondary cementum was laid down on the tooth side of the splinter, and primary cementum on the bone side. We see at *b* deposited secondary cementum covered by a layer of primary cementum. During the preparation of this section also, a tear occurred between the newly deposited cementum, *b* and *e*, and the old cementum, *c*. But there is no tear at *i*, a repaired resorption which extends into the dentin. At *f*, on the surface of the bone, there is a new layer of bundle bone.

We can see from these few cases that Nature's method of repairing injuries of this type is by a deposition of cementum on the injured surfaces, thus embedding the fibers, and reëstablishing connection between the surface of the tooth and the alveolar bone.

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UNIV. OF MICH.

BRIDGEWORK: A CONSIDERATION OF ITS PRINCIPLES AND USES[1]

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I. BRIDGEWORK: ITS EMPIRIC APPLICATION

The term "bridgework" was unfurled on the banner of fixed bridgework with C. L. Richmond as the standard bearer. Waved in the very mouths of the people in the middle seventies, it did not creep into dental literature until the early eighties, although many variations of partial-denture restorations were practised long before, that would today be classified under the heading of bridgework. Born in the darkness of empiricism, it nevertheless immediately became identified in the minds of the people with the halo of a scientific discovery. This identification, although strong, was a negative identification and not a positive one, for to them it represented much too early a release from the destructive naggings of the empiric application of all restorative mechanisms (under the heading of partial dentures or partial plates) that preceded the advent of "Richmond bridgework."

Strange as it may seem, bridgework, despite ravages which are akin only to those of a vast field by an army of locusts, still retains a similar hold upon the people. This is today responsible, as with the use of the term pyorrhea, for its arbitrary and extensive exploitation.

[1] Read at a meeting of the First District Dental Society of the State of New York, Hotel Pennsylvania, December 5, 1927.

Pyorrhea is strongly identified in the minds of the people with the suppurative stage of the disease, bridgework with a superior type of mechanism. Thus a mild gingivitis has become pyorrhea, a clasp denture is called bridgework. The implication, one must confess, is an unpleasant one, but it is none the less true that public receptivity has in many ways negatively influenced our methods of practice rather than that our methods of practice have positively influenced public receptivity. For too readily do we comply with patients' demands based upon the advice they receive from their neighbors.

Empiricism is defined as a practice of medicine founded on mere experience without the aid of science or knowledge of principles —hence an ignorant and unscientific practice. This definition as well as the deduction is Webster's. Thus to treat a headache with an obtundent without ascertaining the causative factors involved is an empiric practice. To insert a mechanical contrivance in the mouth for the purposes of restoring a number of teeth, without having a fundamental knowledge of the principles or relations involved, is also an empiric practice. While scientific methods predominate in medicine and dentistry, empiricism is still very much in evidence in both professions. And not so many years ago empiricism was the predominating note in reconstructive dentistry.

The introduction of porcelain in the late eighteenth century made reconstructive dentistry possible. Its application very soon became rather general. Thus in 1841, in a textbook on prosthetic dentistry by Solyman Brown, the following technic is described: The case presenting itself was an absent lateral on one side and cuspid on the other with the remaining anteriors, roots. A gold plate was swedged over the ridge covering the roots, the edentulous spaces, and part of the palate. The labial portion was festooned to conform with the labial outline of the roots. Metal posts were then driven through the plate to fit into the root canals and subsequently soldered to the plate. Porcelain facings were arranged and retained by means of solder. The case was now completed (*fig. 1*), and inserted in the mouth, with instructions that the patient wind a piece of cotton or floss silk around the metal posts to prevent the wear of the root structure.

This is a very early form of removable appliance. In the same textbook, one finds a technic for the restoration of an individual

central incisor by means of two bent clasps surrounding a bicuspid on either side of the mouth, (*fig.* 2), suggesting that the clasp retention might be utilized only on one side of the mouth, if expense were a factor, but to give the patient necessary instructions not to use the appliance for the purpose of mastication. This last-described technic varies little from a similar one employed rather extensively at the present time.

On examining the literature of this period, one finds that the predominating note in all reconstructive efforts was purely mechanistic; that is, they were concerned with building something which would be held or retained in the mouth, and remain so during mastication. There was, it is true, an awareness of the need for hygiene as exemplified by a rather elaborate caution one finds in the writings of Solyman Brown, to keep the mouth particularly clean; otherwise, as he puts it, the appliance would become useless because the teeth would be destroyed. He seems not to have suspected however, that in some way the appliance had something to do with the destruction of the teeth. This idea of developing a mechanism that might be secure in the mouth of a patient was the chief concern of the profession during the forties, fifties and sixties, until in 1869, in *Dental Cosmos*, Bennett demonstrated the fact that two roots can support three crowns and constructed the first fixed bridge, the chief point of his contribution being its solidity and stationary attributes. At this time, vulcanite was already extensively in use but was carelessly adapted against ragged roots, encroaching deliberately upon the gingivae, and thus producing, together with a destructive effect of the clasps, a decidedly uncomfortable reaction on the patient, which in turn was reflected back to the dental practitioner.

The removable appliances constructed up to this time had been planned, not with any idea of hygiene but because this method was the only mechanical means for retention which had been devised, and hence were quite ready for the discard. These devices failed for lack of a knowledge of the general principles involved. It was at this time that the Richmond crown and the fixed bridge were introduced. It is not difficult to understand why such slogans as, "At last we can put teeth in your mouth that can stay in and feel like your own," or "Have a shell crown put upon a tooth to protect it from any further trouble," were so deceiving.

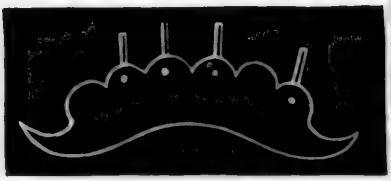

Fig. 1

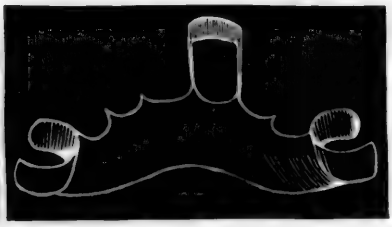

Fig. 2

Fig. 1. Base for early removable bridge. The gold saddle was adapted to the ends of the roots of upper incisor teeth, into the canals of which the pins were inserted. The piece was retained by threads of cotton or linen wound around the posts. Porcelain facings were soldered to the base.

Fig. 2. An early removable gold base carrying a porcelain facing. It was retained by means of clasps.

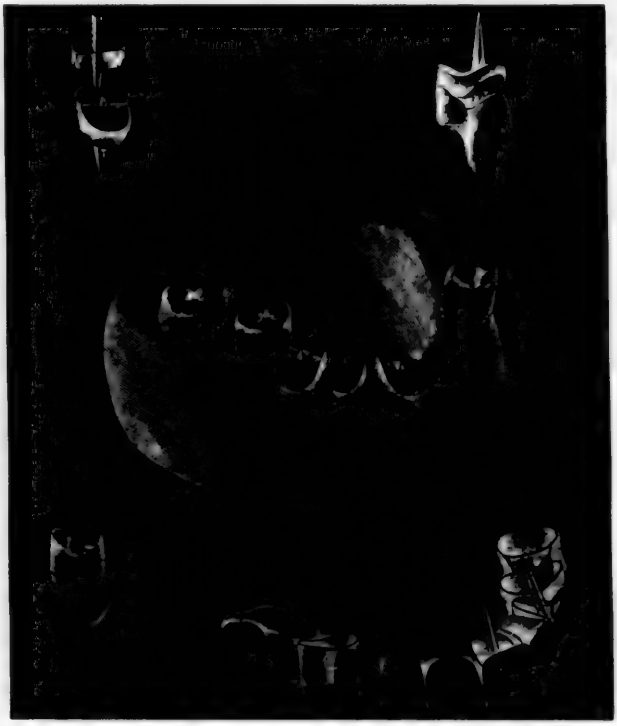

Fig. 3. A removable bridge utilizing the pin and tube on anterior teeth, and the telescope gold crown on the posterior teeth.

Figs. 1–6. Photographs illustrating early appliances in the field of prosthesis.

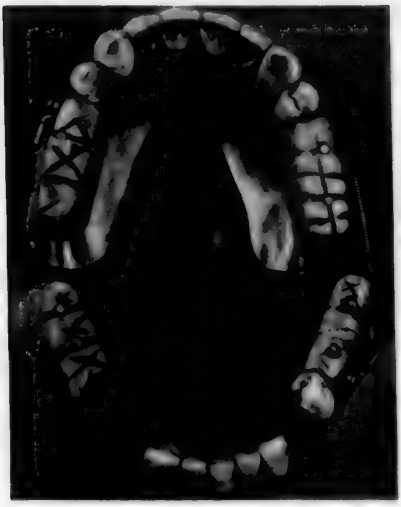

Fig. 4. A full upper denture and a partial lower, estimated to be more than a century old, with the crowns of natural teeth used for the anteriors and first bicuspids and ivory blocks for the remaining posteriors. These are anchored upon swedged gold bases. Note the springs (one of which is missing) utilized to help to retain the dentures. This specimen, an excellent example of French-workmanship of that period, was presented to the writer by Dr. William Kelsey-Fry of Guy's Hospital, London.

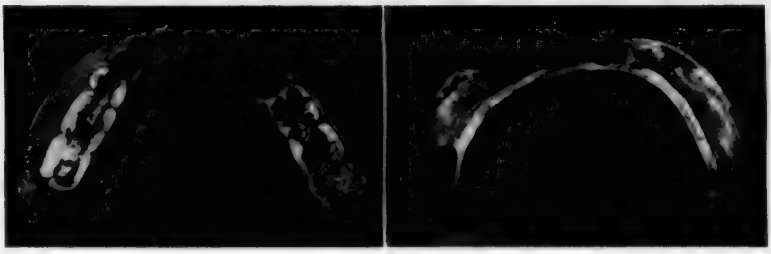

Fig. 5. A partial lower dentire carved out of a piece of walrus tusk. This specimen, a splendid example of French workmanship estimated to be about 150 years old, was presented to the writer by Dr. Frank T. Van Woert, late Dean of the Columbia University Dental School.

Fig. 6. Basal aspect of the partial denture shown in *fig. 5*, with recess cut to accommodate remaining molar.

Figs. 1–6. Photographs illustrating early appliances in the field of prosthesis.

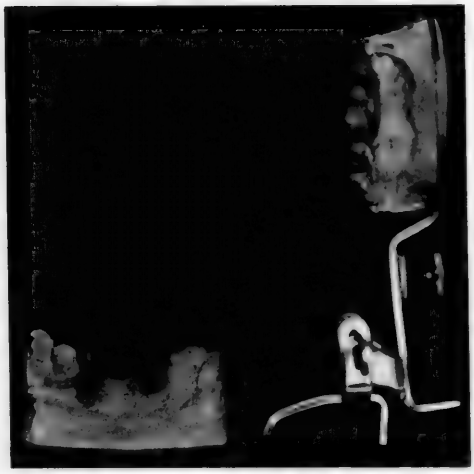

Fig. 7. Models mounted upon Kerr bridge articular, for the restoration of a lower left first molar, by means of a Chayes appliance. Note metal seats for the inlay abutments to assure certainty of position. Also note crowns of opposing teeth reproduced in metal to establish a more exact occlusal relationship.

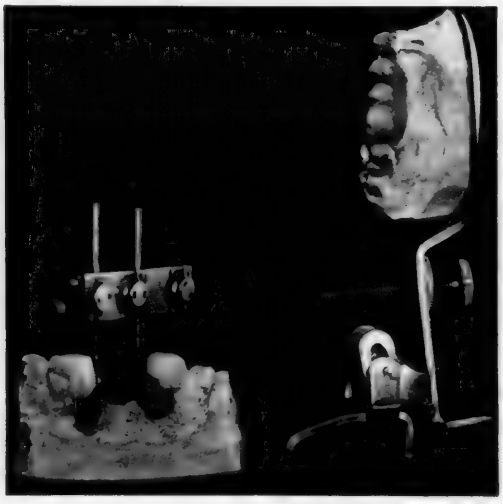

Fig. 8. An absolute parallel relationship established by means of the Chayes Parallelometer and mandrels carrying the female portions of the attachments, and housed within the recesses of the inlays and within the normal anatomic contour of the abutment teeth. Note the inlays plastered in position to prevent any displacement.

Figs. 7–21. Steps showing the construction of a practical, simple, Chayes appliance.

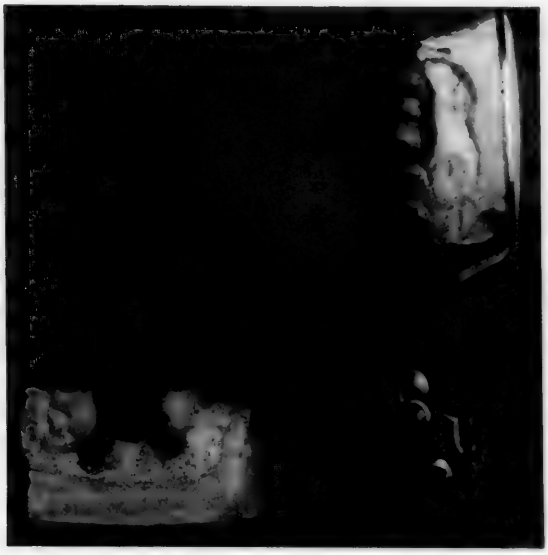

Fig. 9. The parallelometer and mandrels removed, the female portions of the attachments within the inlays being held by sticky wax. The mandrels are replaced by carbons that fit accurately into the platinum hoods. The plaster holding the inlays is now chipped away.

Fig. 10. Inlay containing platinum hood and carbon invested in refractory compound, half of the carbon imbedded in the investment and the hood facing out. Note the cavo surface of the inlay carefully painted with antiflux to prevent solder from flowing upon it. The sticky wax holding the platinum hood is now washed away with boiling water, the edges of the refractory compound carefully removed exposing the whole surface of the inlay, and boiling water again flushed over it.

Fig. 11. The reinforcing plate is now placed over the platinum hood, a little flux added, and the investment put upon a small flame for gradual dehydration. Note the appearance of inlay, platinum hood, and carbon held by sticky wax prior to investing. After complete dehydration, investment being well heated, platinum hood and reinforcing plate are soldered to inlay with 22 K gold until proper surface contour is established. Permit to cool, break away investment, remove carbon, and run inlay through HFl and HCl acid baths. Polish surface and seat back on the model. Same process repeated with other abutment.

Figs. 7–21. Steps showing the construction of a practical, simple, Chayes appliance.

The Richmond crown became the standard abutment for fixed bridgework for some time, and it was therefore necessary to excise perfectly sound crowns. For this the following technic was employed: "Disk a crown labially and lingually at the cervical part and suddenly clip the crown, then very suddenly drive a peg of wood against the

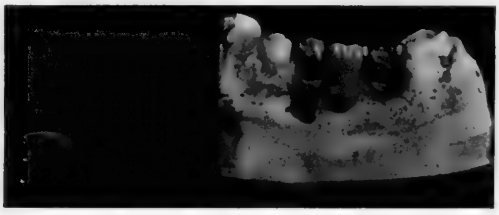

Fig. 12. Porcelain tooth carved from porcelain block, reproducing anatomical contours, harmonizing with adjacent teeth. Note also restoration of gingival contour, which is later stained in the furnace reproducing the gum pigmentation. The crown portion of the tooth is also stained, reproducing the color subtleties of the natural teeth. Grooves are now cut on the proximal sides of the porcelain tooth to be replaced by metal trusses.

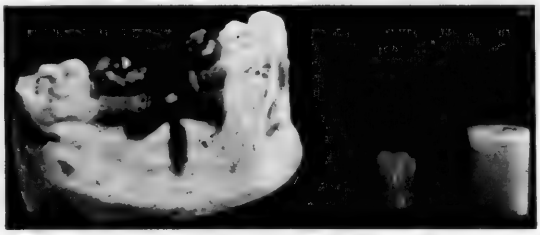

Fig. 13. Wax patterns of uniform thinness to act as a frame for the porcelain tooth. Note sprue attachment to center of saddle portion. Note metal pin or dowel attached to center of seat. Also note porcelain tooth removed from wax pattern, and porcelain block from which it is carved.

Figs. 7–21. Steps showing the construction of a practical, simple, Chayes appliance.

vital nerve into the canal and leave the peg within to obviate subsequent trouble." All this without anesthesia. Naturally, fixed bridgework required a good deal of defending, part of which it received in 1883 from J. L. Williams in the paper entitled: "A consideration of the merits and claims of fixed bridgework," his chief point being a defense of devitalization on the basis of histological data. But

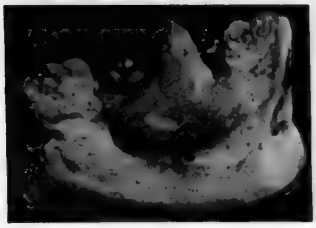

Fig. 14

Fig. 15

Fig. 14. First application of refractory compound carefully painted upon the wax pattern and covering it entirely while still on the model, permitting sprue to extend. Allow investment to harden.

Fig. 15. Remove pattern with investment covering, and place, after moistening, in position upon the sprue former. Paint reverse side carefully with investment, place ring in position upon sprue former, and fill with investment. Allow to set, remove base and sprue, and carry through the dehydration process in the same way as for inlay cast. Permit final cooling before casting.

Fig. 16

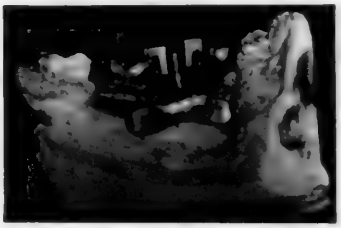

Fig. 17

Fig. 16. Button of surplus gold removed, porcelain tooth seated into metal frame, and metal frame seated in position upon model.

Fig. 17. Porcelain tooth removed from frame. Grooves cut in metal trusses opposite grooves of platinum hoods within inlays, and male portions of attachment fitted in position within female portion, the arm of the male portion engaging the groove within the truss of the metal frame and extending beyond it. These attachments are waxed into position to the metal truss.

Figs. 7–21. Steps showing the construction of a practical, simple, Chayes appliance.

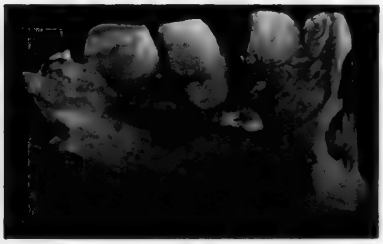

Fig. 18

Fig. 19

Fig. 18. Inlays plastered to metal seats to assure accuracy of position. Male attachment held in rigid position by means of additional plaster. Note that only one attachment is soldered at a time.

Fig. 19. Metal frame carrying male attachment, held in position to truss by means of plaster. Male attachment and truss on outer side carefully antifluxed, and fork of slate guided into position between male attachment and truss to prevent solder from flowing through. Refractory compound is now carefully painted on, and the rest of the metal frame imbedded in investment. After hardening, plaster is chipped away, wax is boiled out, a little flux added, and investment heated prior to soldering.

Fig. 20

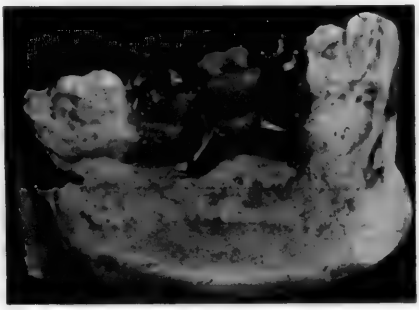

Fig. 21

Fig. 20. Appliance disassembled, showing the cavo surfaces of the inlay abutments and the tooth restored. Note the projecting male attachments. Also note the contour of gingival ridge upon the porcelain tooth. At this stage the pigments are fused upon the porcelain.

Fig. 21. Both attachments soldered to the metal trusses, the surplus of the extending arms being cut away and the tooth reseated. Appliance, metal frame, plus porcelain tooth, plus male attachment, slipped into position in the female portions of the attachments within abutment teeth. Only absolute parallelism and precision of technic will allow appliance to slip in position on model.

Figs. 7–21. Steps showing the construction of a practical, simple, Chayes appliance.

Williams no longer holds that point of view. For a time, the problem of the devitalization of sound teeth overshadowed the question of hygiene.

We have now mentioned the three types of appliances that basically have remained in use to the present time, with a series of modifications which have perforce been made to meet mechanical and physiological requirements: (1) The appliance with the posts driven into the roots; (2) the clasp denture; (3) the fixed bridge with the Richmond and shell crown abutments. At this time the consciousness of the dental profession regarding the fundamental requirements began to grow, and today there is almost a universal realization of what these requirements may be, although by no means a universal agreement as to the technic that will best meet them. The first of these fundamental requirements is hygiene, and, as we have seen, this was very early recognized. The second: to prevent injury of the gingiva, peridental membrane and bony structures surrounding the tooth. The third: to prevent unnecessary injury of the abutment tooth. The fourth: to prevent undue strain against the abutment tooth. The fifth: to prevent injury to the underlying soft and hard tissues.

Richmond himself realized, from the standpoint of hygiene, the inadequacy of the fixed bridge as employed at the time, and in his first written contribution in 1892 in the *International Dental Journal* gave to the profession what has since been developed into the Peeso bridge, through modification of the crude appliance first described. In short, instead of having the post slide directly into the root, he made it slide within a metal tube attached to a coping which was sealed within the root. In the same paper, he also described what he called the telescope band fitted over a shell crown, from which the telescope crown developed. His own conclusions in describing a series of cases so constructed were to use removable bridgework in all cases because it was easily cleaned, and easily and cheaply repaired. The subsequent series of papers by Richmond concerned themselves entirely with removable appliances, using the type of attachment now known as the split pin and tube and the telescope crown (*fig. 3*).

This was the first scientific effort. It implied the realization of some fundamental laws and genuine effort to work in conformity with them. And it sounded the death-knell of empiricism in bridgework. As our

consciousness began to develop in regard to the need of conforming to the requirements enumerated, stimulated by the experience of failure, so also ingenuity developed. And gradually mechanical restorations became more scientific.

Fig. 22 (Case 1). A simple appliance restoring two upper centrals and a lateral. This appliance carries the male parts of the attachments, the female parts being housed within three-quarter crowns upon vital lateral and cuspid. Note the gum enamel baked on the labial aspect and the saddle extension. *See fig. 23.*

Fig. 23 (Case 1). Chayes appliance restoring upper right and left central incisors and left lateral incisor, in position in the mouth (*fig. 22*). Method of anchorage is an onlay engaging distal, lingual and mesial surfaces. Note total absence of metal showing from the labial aspect. *See fig. 24.*

Fig. 24 (Case 1). With aid of reflecting disc, lingual aspect of appliance is visible (*figs. 22* and *23*). Note saddle portion of appliance adapted against the palate.

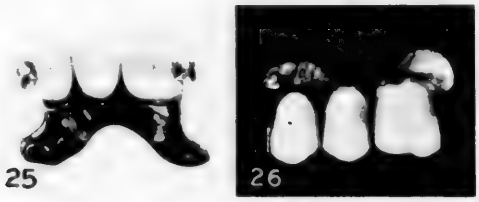

Fig. 25 (Case 2). Appliance restoring two upper bicuspids and one molar. Note male parts of attachments. These fit into female jackets housed respectively within a cast base porcelain crown of upper cuspid and an M.O. inlay within second molar. Note saddle design. Occlusal and lingual view. *See fig. 26.*

Fig. 26 (Case 2). Buccal view (*fig. 25*).

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

II. BRIDGEWORK AND HYGIENE

The fixed bridge, however, continued to be more ruthlessly and more generally applied. The shell crown became a favorite abutment and

was promiscuously slipped over natural crowns, a considerable amount of tooth structure being frequently destroyed in the attempt to get some sort of adaptation at the gingival line. The result was that con-

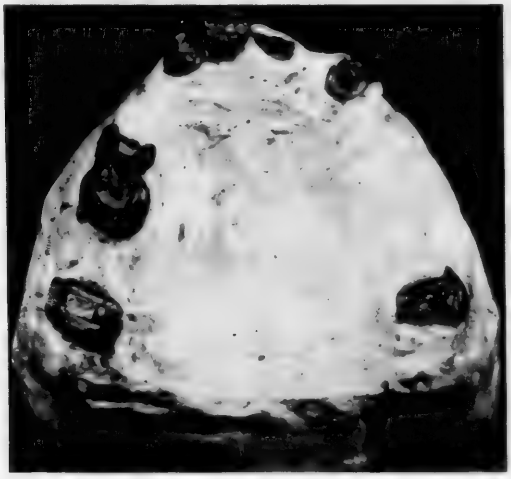

Fig. 27 (Case 3). Model showing badly disrupted upper dental arch with broken down vital right central and lateral; vital right second bicuspid and first molar; non-vital right third molar; left central, cuspid, and third molar roots. The right central was individually restored with a porcelain jacket crown and two separate appliances were constructed. For the left appliance, cast-base porcelain crowns were constructed upon the central, cuspid, and third molar roots, which carried the female portion of the attachments on the distal of the central and cuspid crowns, and the mesial of the third molar crown, with an additional rest or stabilizer within a recess at the mesio-lingual of the cuspid crown. For the right appliance, a three-quarter crown, carrying the female part of the attachment distally, was constructed upon the right lateral, a mesio-occlusal inlay carrying the female part of the attachment mesially for the right second bicuspid, a mesio-occlusal inlay carrying the female part of the attachment for the right third molar and a recess within the disto-occlusal inlay of the right first molar for the reception of a rest or stabilizer. *See fig. 28.*

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

siderable injury was done to the pulp, making it sensitive to thermal changes, so that for a brief period not many years ago it was considered good practice to devitalize all teeth that were to be so crowned. At about the same time, it also became good practice to crown all

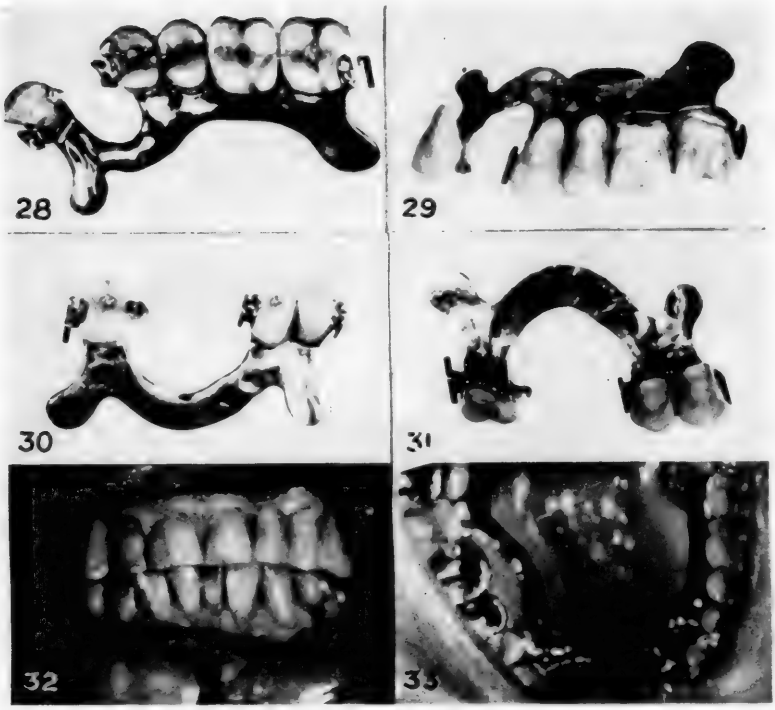

Fig. 28 (Case 3). Occlusal and lingual view of the left appliance restoring the lateral and posteriors (*fig. 27*). Note male parts of attachments and stabilizer distally to the lateral. Also note saddle design considerably removed from gingival crests. *See fig. 29.*

Fig. 29 (Case 3). Buccal aspect of left appliance (*figs. 27* and *28*). *See fig. 30.*

Fig. 30 (Case 3). Occlusal and lingual view of right appliance restoring cuspid, first bicuspid and second molar (*figs. 27–29*). Note male parts of attachments and stabilizer mesially to second molar. Also note saddle design skipping second bicuspid and first molar, and sufficiently removed from gingival crests. *See fig. 31.*

Fig. 31 (Case 3). Buccal aspect of right appliance (*figs. 27–30*). *See fig. 32.*

Fig. 32 (Case 3). Appliances in position in reconstructed mouth (*figs. 27–31*). Note jacket crown on vital right central; cast base crowns on left central and bicuspid roots; three-quarter crown on vital right lateral, etc. *See fig. 33.*

Fig. 33 (Case 3). Palatal aspect of appliances in position (*figs. 27–32*), viewed through a reflector.

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

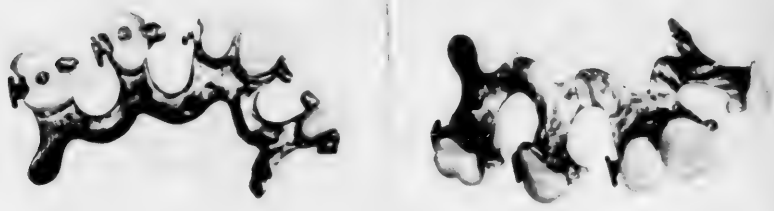

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Fig. 34 (Case 4). *Case history.* Patient had carried fixed appliance restoring upper *right* central and lateral, first bicuspid, and first molar, upper *left* lateral, second bicuspid, and first molar. There were gold shell-crown abutments on upper *right* cuspid, second bicuspid and second molar, and upper *left* cuspid, first bicuspid, and second molar, with a Richmond crown upon upper *left* central root.

Model shows cavity preparation in all vital abutments and cast-base porcelain crown on upper *left* central root; three-quarter crown preparation on upper *right* cuspid; M.O.D. inlay in upper *right* second bicuspid; M.O. inlay in upper *right* second molar; mesio-lingual preparation in upper *left* cuspid; D.O. inlay in upper *left* first bicuspid; and M.O. inlay in upper *left* second molar. Note shallow depth of preparations. *See fig. 35.*

Fig. 35 (Case 4). Inlays carrying female parts of attachments in position within prepared cavities (*fig. 34*). Note the placement of the attachments within the normal anatomic circumference of each tooth. Two separate appliances were constructed: the left restoring upper second bicusped and first molar; the right restoring the left lateral, right central and lateral, first bicuspid and first molar. Stabilizers were placed on the mesial and distal of the porcelain crown on the left central, and disto-occlusally on the right first molar, and disto-lingually on the right cuspid. *See fig. 36.*

Fig. 36 (Case 4). Occlusal and lingual view of upper right appliance (figs. 34 and 35). Note male part of attachments with stabilizers enumerated in previous caption. Also note saddle design and its distribution sufficiently removed from the gingival crests of the remaining teeth. *See fig. 37.*

Fig. 37 (Case 4). Labial and buccal aspect of right appliance (*figs. 34–36*). *See fig. 38.*

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

teeth that were to be clasped in the attempt to obviate the destructive effect of the clasps.

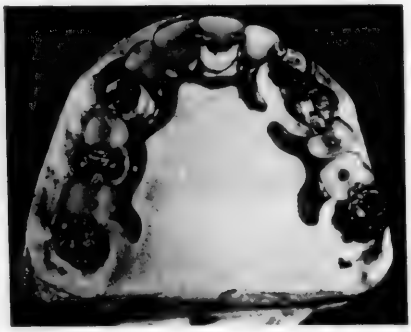

Fig. 38 (Case 4). Both appliances in position on the model (*figs. 34–37*).

Fig. 39 (Case 5). Model showing cast-base crowns on lower left and right cuspid roots carrying female parts of attachments distally. The lower incisors are the only other remaining teeth. *See fig. 40.*

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

In the meantime, disease in the mouth was increasing owing to the application of the fixed bridge as the result of careless devitalization, irritation of the shell crown and Richmond bands against gingiva and peridental membrane, the jamming of pontics into the gingival tissues,

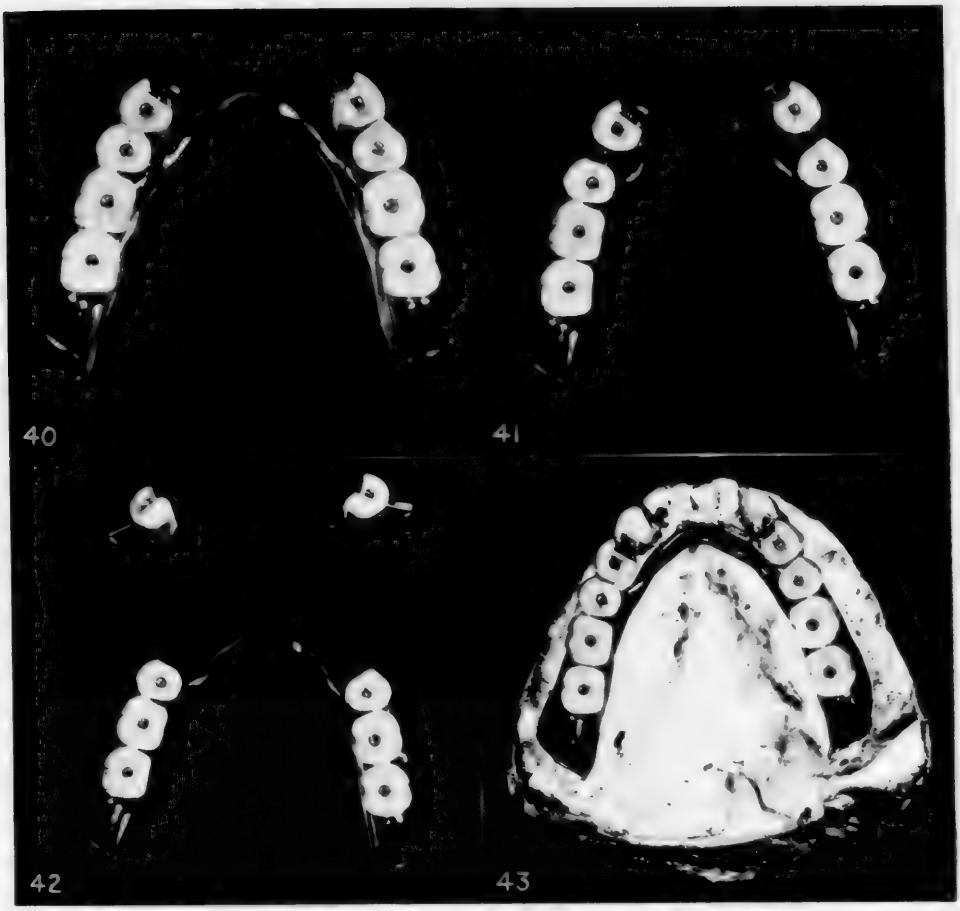

Fig. 40 (Case 5). Complete lower appliance (*fig. 39*). Note male parts of bucco-lingual attachments mesially to the first bicuspids and distal extensions or stress breakers between the first and second bicuspids held in position by set screws inserted lingually into the saddle. *See fig. 41.*

Fig. 41 (Case 5). The first bicuspids partially removed from position (*figs. 39* and *40*), showing part of the distal extension reaching into the second bicuspids. *See fig. 42.*

Fig. 42 (Case 5). The first bicuspids entirely removed from the appliance (*figs. 39–41*) showing that complete distal extensions permit yielding between the first and second bicuspids, and tend to remove part of the strain from the cuspid abutments. *See fig. 43.*

Fig. 43 (Case 5). Assembled appliance in position on the model (*figs. 39–42*).

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

Fig. 44 (Case 6). A lower left cantilever appliance restoring two molars. This is the only appliance which perforce requires the devitalization of the posterior remaining tooth, in this case the lower second bicuspid.

The crown must be excised and a cast-base constructed upon the root carrying an upright attachment centered upon it, and parallelled to a bucco-lingual attachment within an inlay cast in the vital first upper. Because of the necessity for devitalization of the one abutment, this type of appliance perhaps has its limitations and might be employed in specially selected cases, particularly for that large group where the last abutment is already nonvital or in itself requires devitalization. The crown carrying the Steele facing with the female jacket of the upright is cast against the base. The male part of the bucco-lingual attachment is soldered mesially to the crown, and a distal extension distally and running into the first molar of the bridge portion to break the stress.

Model mounted on Kerr anatomic articulator shows the cast-base with its upright soldered to it in position, and the inlay carrying the female portion of the bucco-lingual attachment seated within the first bicuspid and parallelled to the upright. *See fig. 45.*

Fig. 45 (Case 6). Occlusal view of completed appliance (*fig. 44*). Showing cast second bicuspid crown with the female part of the upright running through its center, and the male bucco-lingual attachment soldered to its mesial aspect and paralleled to the upright. *See fig. 46.*

Fig. 46 (Case 6). Lingual view of completed appliance (*figs. 44* and *45*), with distal extension running into the first molar. Note set screw holding distal extension in place. Also note saddle extension forward and reaching as far as the root area of the first bicuspid and cleared from the gingival crests. This saddle extension gives additional balancing support, and aids in the stimulation of the tissues surrounding the non-vital root. *See fig. 47.*

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

and the crowding of foods in and around the appliance. People suffered from maladies with obscure causative factors that baffled physicians who treated them empirically. One finds evidence in the

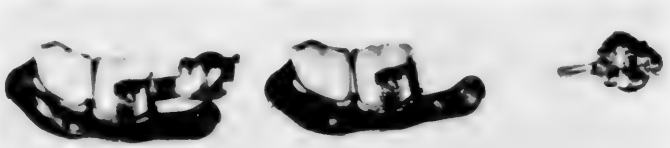

Fig. 47 (Case 6). Same as *fig. 46*, with the set screw loosened and the bicuspid crown partly removed from position. *See fig. 48.*

Fig. 48 (Case 6). Same as *figs. 46* and *47*, with the bicuspid crown entirely removed from position, and showing the distal extension, the jacket of the upright, and the male portion of the bucco-lingual attachment. *See fig. 49.*

Fig. 49 (Case 6). Completed appliance (*figs. 44–48*) in position on the model. Buccal view. Note recess in buccal surface of second-bicuspid crown for the reception of a porcelain inlay. The occlusion in this case is too close to permit the use of a Steele facing. *See fig. 50.*

Fig. 50 (Case 6). Lingual view of appliance (*figs. 44–49*) in position on the model.

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

records of considerable individual awareness among the members of the dental profession of the unhygienic conditions that prevailed, and modification of the fixed bridge then began. The Richmond crown

was no longer used for esthetic purposes in place of the sound natural crown. The shell crown took its place, with the labial surface cut out, resulting in the open face crown. The banded Richmond crown was modified by Darby, who fitted a piece of plate gold to conform to the periphery of the root to prevent injury of the investing tissues: pontics were constructed with wide interproximal spaces and placed lightly against the gingiva; and finally pontics were constructed so as to con-

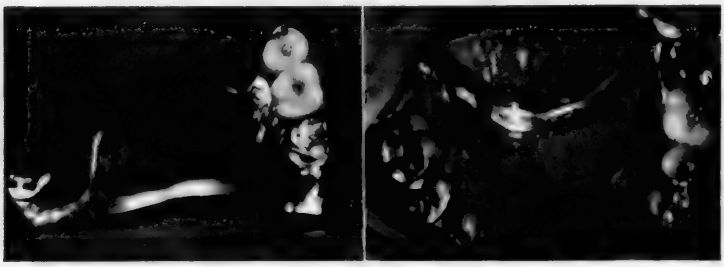

Fig. 51 (Case 7). An appliance restoring upper left second bicuspid and two molars, with a vital left first bicuspid in position. This case necessitates the extension of the saddle across the palate to the last molar on the opposite side. Bucco-lingual attachments were placed distally within inlays constructed for upper left first bicuspid and upper right second molar. Note saddle design with balancing extensions anteriorly. Note finger stabilizer extending toward the lingual surface of the upper right second molar. This rests upon the inlay and not upon tooth structure. Also note gold casting for left second molar necessitated because of the closeness of the bite. *See fig. 52.*

Fig. 52 (Case 7). Appliance in position in the mouth viewed through a reflector (*fig. 51*). Note saddle design; also note inlays for vital right posterior which are independent of the appliance.

Figs. 22–52. Photographs of practical cases illustrating the application of Chayes bridgework to a variety of conditions requiring restorative mechanisms.

sist of only biting areas with a free space underneath, the so-called self-cleansing bridge.

Peeso bridgework has remained the same in its principles, even to the present day, but perhaps somewhat more carefully executed technically; but still utilizing the split pin and tube, and the telescope crown, which necessitate devitalization of all abutment teeth. These modifications however proved inadequate and criticism continued, particularly from clasp-denture workers and individual acute observers. One of these was Black, who imparted the results of his keen

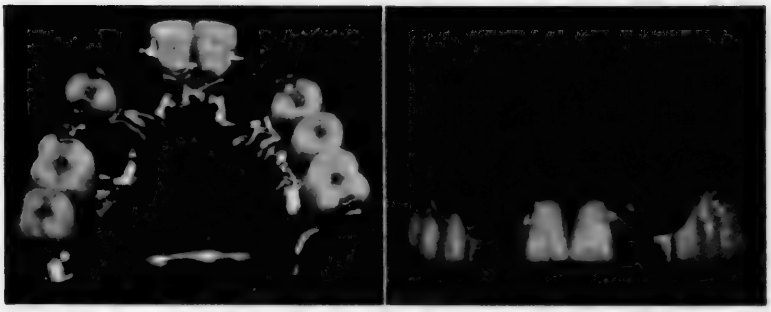

Fig. 53 (Case 8). The first of these cases (*figs. 53–55*) has now given service for approximately three years. The general conditions of abutments is now more encouraging than at the time of the reconstruction. The teeth present in the mouth in this case were upper *left* lateral and cuspid roots, and a very badly broken down but vital third molar, upper *right* vital lateral, non-vital cuspid, and second bicuspid root. All of the teeth looked precarious and unsafe, and suggestion was firmly made to render the mouth edentulous. Patient, a woman about 50, was more than willing to coöperate for the last resort.

Reconstruction. A nearly complete crown was cast for the left third molar without devitalization. This crown carried a bucco-lingual attachment mesially, a cast-base porcelain crown constructed for left cuspid root carrying bucco-lingual attachments distally, individual cast-base porcelain crown constructed for left lateral root containing a recess mesially for reception of stabilizer, inlay constructed for right lateral containing recess for reception of stabilizer mesially, inlay constructed for non-vital cuspid containing bucco-lingual attachment distally, cast-base crown constructed for right second bicuspid root containing bucco-lingual attachment distally, and recess mesially for reception of stabilizer.

Appliance with four bucco-lingual attachments and three stabilizers. Note saddle design removed from region of gingival crests. *See fig. 54.*

Fig. 54 (Case 8). Anterior view of appliance (*fig. 53*). *See fig. 55.*

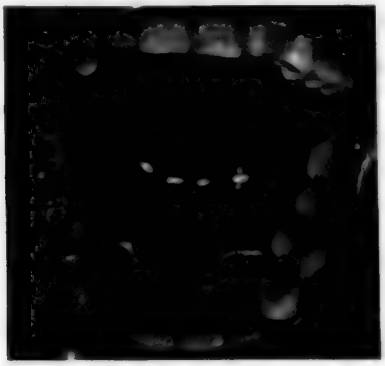

Fig. 55 (Case 8). Appliance (*figs. 53* and *54*) in position in the mouth, viewed in reflector. Note the saddle design removed from the gingival crests.

Figs. 53–57. Two so-called "spectacular" or "border-line" cases constructed as a last resort before making the mouth edentulous.

observations regarding particularly detailed anatomical formations of teeth and their relationship to each other and who, with his consideration and application of physical laws, placed the conception and technic for the cutting of cavities upon a definite scientific basis that

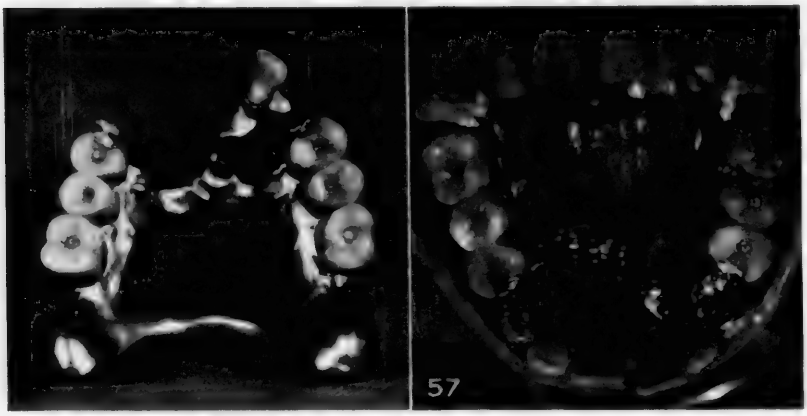

Fig. 56 (Case 9). This is a similar border-line case where suggestion was first made to render the mouth edentulous. Patient, a woman about 65, with vital right and left centrals, right lateral and cuspid, and left cuspid root. Clinical and radiographic evidence were by no means encouraging, but the experiment was made. The appliance was first constructed with a clasp surrounding upper right cuspid, as it was desired not to cut into the crown. In a period of six months the cuspid had loosened considerably more, and the appliance was reconstructed as follows: Cast-base porcelain crown with bucco-lingual attachments distally, and recess for stabilizer mesially upon left cuspid root; mesio-lingual inlay for right cuspid containing bucco-lingual attachment distally. The appliance has now been giving service for two years, with the remaining teeth considerably firmer than before the period of reconstruction. *See fig. 57.*

Appliance shows two bucco-lingual attachments and one stabilizer. Note saddle design and saddle extension over condyles.

Fig. 57 (Case 9). Appliance in position in the mouth viewed in a reflector (*fig. 56*).

Figs. 53–57. Two so-called "spectacular" or "border-line" cases constructed as a last resort before making the mouth edentulous.

is today universally accepted, but by no means universally applied. Another was Taggart, who was silently at work at what was to become one of the greatest single achievements in the dental profession. Still another was Chayes, who in *Dental Items of Interest* for October, 1910, presented a sound and severe indictment in the following words:

"Crown and bridgework has been the worst sort of a makeshift and, if at times its destructive work has been hidden in a period of temporary satisfaction, it has been no less destructive in the end. It has become apparent upon close study of the dynamics, physics and relations involved that no important point necessary to the success of the appliance and essential to the physiological well-being of the patients and to their hygienic integrity has been considered except perhaps the one requirement of filling the space which is devoid of dental members."

But Black and Taggart were sluggishly accepted, and Chayes created little excitement—at that time. Criticism was to be more spectacularly effective from a source both professionally and geographically removed. Only a few months later, in February 1911, William Hunter at McGill University broadcast his indictment that compelled both the dental and medical professions to "tune in." "Septic American Dentistry" was a term that branded American Dentistry. "It is not a matter of teeth and dentistry—it is an all-important matter of sepsis and anti-sepsis that concerns every branch of the medical profession and concerns very closely the public health of the community." And teeth ceased to be a matter of local consideration—they became an integral part of the entire constitution. To minister to the care of teeth meant to minister to the health and life of the human being. It is still pertinent to re-read Dr. Hunter's remarks. His data stimulated activity in both the medical and dental professions, and were feverishly confirmed.

III. BRIDGEWORK AND ABUTMENTS

It is difficult to realize just what might have happened if Taggart had not some three years earlier in 1907 completed his casting process. It is the good fortune of all concerned, that the cast gold inlay has successfully met the natural requirements for abutment teeth. For with it, it has become possible with comparative safety to retain the vitality of abutments; it has become possible to restore the detailed anatomical contour of abutment teeth; it has become possible to prevent disturbing the relations at the gingiva; and, when such relations have already become affected, to rehabilitate these tissues. The Darby base and the Richmond crown have both been supplanted by the cast base, which can be constructed in contiguous relation with

the periphery of the root, effecting at the same time restoration of contour of the cervical enamel ridge of the crown against which the free margin of the gum rests unattached. Careful attention should be given to the rehabilitation of proper contour in the region of the free margin of the gum, for an over-contour would produce a strangulation of the arterioles, an under-contour would produce a collapse of the tissue, and each would result in degenerative changes.

A full crown when employed has the same objective, and can today be constructed to be contiguous with the root of the tooth at its cervical relation, with a slight shoulder preparation or in some instances shoulderless, at the same time effecting the proper peripheral contour in relation to the free margin of the gum. These objectives are being met and the shell crown is thus becoming obsolete. It is true that this does not as yet appear to have occurred, judging from the tremendous sales of shell crowns by the supply houses, and from the place the shell crown still holds in most dental educational institutions. But its obsolescence is a fact in scientific circles and among scientific investigators. It is also true that its sales have been diminishing, and that its application in dental schools is taught with more than a little reservation.

Naturally the fixed-bridge workers accepted these modifications, and the requirements so far enumerated for abutments were beginning to be well met. The clasp-denture workers on the other hand, were not very much affected, and modifications which have resulted in their field have been adopted, as we shall see, for other reasons. The removable-bridge field was usurped almost entirely by Peeso with the exception of two additional contributions. One was the split bar or Bennett blade. This bar consisted of a double strip of hard tempered alloy open at the side away from the ridge, which was soldered to shell crown abutments very close to the ridge. The appliance contained a counter groove that slipped over the split bar. This appliance was short lived and nothing more need be said about it. Another was the mesio-distal attachment with which Drs. Richard Blum and Herman Chayes were identified. This attachment was used in connection with inlays running in a mesio-distal direction of a crown, and necessitated devitalization of abutments at all times. This attachment was never extensively applied and was also short lived, unless it is still being employed by Dr. Blum.

In June, 1915, in *Dental Items of Interest* our consciousness was awakened, by Dr. Chayes, to another very important fundamental requirement for abutment teeth. His familiar slogan, "teeth move in function," is now the subject of discussion in all phases of reconstructive appliances, and its principle has influenced a series of modifications with practically all forms of restorations. This observation focussed attention upon a yield in the relationship between the tooth and its investing tissues. It focussed attention upon the importance of this yield in that during function the surrounding tissues of the abutment tooth received vascular stimulation because of its mobility, even as any other part of the body receives vascular stimulation through constant functional mobility. Chayes' dictum called attention to the fact that, when interference with this yield or the fixation of abutments occurred, stasis ensued and degenerative changes were the result. This observation also implied that all undue stress was to be released from the abutment teeth during function and was to be taken up by the underlying tissues of the appliance instead. It also implied that undue strain against the abutments was to be prevented during the insertion of the appliance as in the case of the fixed bridge, or during the insertion and removal of the appliance as in the case of removable restorations. It is, of course, very important to be in agreement about the value of this contribution, for if it be accepted, mechanical appliances must in some way be designed to meet the requirement.

It cannot be said with Stanley Tylman in the August, 1927 issue of the *Journal of the American Dental Association*, "that the cause of the glaring failures of fixed bridgework does not lie in the principle of fixation itself but in the disregard of the mandates of biology and mechanics—that if the fundamentals are understood and applied, methods need not hinder us." What an obvious contradiction. Is it reasonable to assume that a method to be employed bears no relation to understood fundamental mandates of biology and mechanics? But Dr. Tylman goes on to tell a naïve story, by way of illustration, of a violinist, who on the concert platform snapped three of his strings and faultlessly completed a difficult sonata on the remaining G string. It is not necessary to string out the parallel. It can rather be said with James K. Burgess, who in a few minutes will discuss this paper,

"that the claim that teeth move in function, and that it is necessary that they shall so move, is not well taken—that Dr. Hopewell-Smith has made a counter-claim that teeth do not move in function."

This is a bald statement, sound and reasonable. Being an advocate of a method which disregards the principle, it is logical that he should deny the existence of it. Dr. Burgess goes on to confuse the discussion of the normal yield in the relation between teeth in their investing tissues with a discussion of loose teeth as the result of some destruction of the moorings. But in the next breath he relents entirely, seems to understand the principle involved, and allows that, even if such a yield does exist, fixed bridgework does not interfere with it.

Having no references to Dr. Hopewell-Smith's discussion on the question of 'mobility of teeth during function,' I wrote to him asking for a statement of his point of view and for a notation of his references, to which I received the following reply (November 19, 1927):

"I have stated several times in the dental press and elsewhere my conviction that teeth do not move in their sockets as a normal thing. They appear to do so when grasped by the finger and thumb. The articulation of the normal tooth is by a firm fibrous gomphosis, comparable to the way the cranial bones are articulated. You will find the latest statement to this effect in the *Dental Cosmos*, May 1927, page 478, near the bottom of the first column. I cannot give you the other references off hand, but if you require them I will with pleasure look them up. There is no movement of the teeth of the lower animals in their sockets."

To this I replied as follows (November 21, 1927):

"I am trying to conduct a sort of investigation on the question involved and while your statement in itself is interesting, I would really desire to go over the additional references you speak of in the effort to find some histological or other justification for your point of view. Certain clinical evidences have been presented in support of the idea, as for example the evidence of proximal wear at contact points and the evidence that, in bringing the teeth together under normal pressure, a definite sensation of yield or give is felt. It is also contended in opposition to your point of view as of the May *Cosmos*, 1927, that a definite fixation would rather transmit percussion to cranial centers than the presence of resiliency or yield. The comparison has been made on that point with the baseball player, who in a moment of grasp as the ball is thrown to him, suddenly releases his hand to break the impact."

At the same time (November 21, 1927) I wrote to Dr. Charles F. Bödecker as follows:

"I am interested in the question of mobility of teeth during function. In a statement just received from Hopewell-Smith, he compares the articulation of a normal tooth to the way cranial bones are articulated. Clinical evidence shows wear of proximal surfaces at contact points, and normal pressure exerted when teeth are in occlusion gives sensation of yield. Hopewell-Smith also argues that, if such a yield existed, there would be constant sensation of pain during mastication. This is contrary to the opposite viewpoint, which holds that the definite fixed relation between the teeth and the alveolar process would transmit all sensation to the cranial centers. Would you kindly favor me with a statement of your attitude?"

I subsequently received the following replies from Drs. Hopewell-Smith and Bödecker:

"Enclosed you will find a questionnaire with my replies, some of which answer your queries. I have striking evidence of the correctness of Answer I,—(which is that 'It is by no means certain that the contact points *do* show signs of wear.')[1] The definite sensation of 'yield' or 'give,' which is experienced in occlusion only takes place when the *mind* is concentrated on it. We do not feel the soles of our shoes in walking, unless we are actually *wondering* whether we feel them. I cannot conceive that a fixed articulation on the part of the teeth would transmit 'percussion to the cranial centres' during the act of occlusion." *P. S.* Intend some day to publish my answers to the Canadian Oral Society.—*Arthur Hopewell-Smith*, December 4, 1927.

"Your inquiry concerning the statement of Hopewell-Smith about the mobility of the teeth during function interested me extremely. When I first heard his viewpoint I intended answering him, but am glad to hear that you will do so. You are undoubtedly correct in believing that the teeth move in function, for the very histological picture of the distribution of the fibers of the peridental membrane show this to be a fact. They are not stretched tense and taut from the cementum of the root to the surrounding alveolar process, but follow a slightly wavy course, giving them the opportunity of straightening and thus allowing the tooth to move under

[1] Across his questionnaire Dr. Hopewell-Smith wrote, in red ink: "Not for publication." But I have taken the liberty to insert the answer to Question 1 because otherwise the comment would have no meaning here.

pressure of mastication. If it would be of any assistance to you, I would be glad to add a paragraph to your paper and furnish a photomicograph proving this to be a fact."—*Charles F. Bödecker*, November 27, 1927.

The proposed paragraph follows:

Concerning the mobility of the teeth. The contention that the teeth are immovably fixed in the surrounding bone is contrary to clinical experience as well as to the histological picture of the tissues involved. The peridental membrane, as we know, retains the individual teeth in the alveoli and it is the fibers of this tissue which fulfill this function. A study of the distribution of the fibers of the peridental membrane discloses the fact that the tooth is *literally suspended* in the alveolus, allowing both a vertical and a lateral movement. It is however not only the arrangement of the fibers which suggests the possibility of the individual movement of the teeth in the alveoli, but the course described by each fiber. If the peridental membrane is examined under a medium power of magnification under the microscope, we note that the individual fibers are not stretched taut and straight across from the cementum to the bone, but follow a slightly wavy or spiral course. This spiral course of the fibers therefore allows the tooth a slight amount of motion in various directions in response to the normal pressure of mastication.—*Charles F. Bödecker*, December 1, 1927.

Let us consider the various elements of the principle involved and see if we may come to agreement about some of them.

1. No undue stress to be transmitted to abutment teeth during insertion as with a fixed appliance, or during insertion or removal as with a removable appliance. This implies a perfectly parallel relationship between the attachments of the abutments so that the appliance, without traumatizing the investing tissues, may slip into position and be perfectly seated and with equal ease slip out of position. With a fixed appliance with inlay attachments, it implies that the cavities prepared for the reception of the inlays must be in perfectly parallel relationship—that all their axial walls must be either in perfectly parallel relationship or in a similar degree of convergence. There is perhaps the same degree of chance in accomplishing this as there is in drawing thirteen spades in bridge or a royal flush in poker. It is difficult enough to seat perfectly an individual inlay, without the additional problem of seating two inlays at the same time in teeth hav-

ing different inclinations and placed some distance apart. Perhaps in recognition of this difficulty, the fixed bridge has again recently been modified so that it is attached only at one end, with a rest fitted within an inlay, but unattached to it, at the other end. This modification can, however, be applied only with single tooth restorations, because the leverage is too great for use in a longer span. The second part of this statement refers to removable appliances, and calls upon the need to establish a relationship of perfect parallelism between the attachments used to obviate the evident trauma against abutments during insertion and removal, and to permit of a perfect seating of the appliance.

2. The strain, as far as possible, to be removed from the abutment teeth while the appliance is in position during function, and to be taken up instead by the underlying tissues in such a way as to cause stimulation of those tissues and not an accumulative unidirectional strain. This could not be more clearly re-stated than in the following language by Burgess in the April, 1926 issue of *Dental Outlook:*

"I refer to the mobility of the bridge span and the extent of its basal surface brought into relation with the tissues. This flexibility has a two-fold purpose: (1) To accommodate and to harmonize with the individual tooth movement. (2) For reason of its play against the tissues in function, to stimulate the circulation in these parts. If it is important to foster this tooth movement, it would seem that the same degree in which it is fostered or its control in a given case is equally important. To this end it would seem necessary to harmonize the degrees of rigidity and flexibility inherent in the mechanical anchoring of the attachments themselves with the quality and compressibility of the peridental membrane of the given case."

I should like to call attention at this point to another contradiction, in that, allowing for the compressibility of the peridental membrane, it must necessarily be pre-supposed that the tooth which the peridental membrane surrounds has some degree of movement. To continue to quote from Burgess: "To one frankly not familiar with their use it would seem an extremely difficult undertaking. If movement is insisted upon, its latitude also should be insisted upon. Too much will be as bad as too little and too little as bad as too much in such a scheme of things."

This statement centers our attention once more upon the partial denture. The earliest form of attachment of the partial denture was the simple wrought-band clasp. This type of anchorage made the appliance tissue-bearing; that is, the strain was taken up almost entirely by the underlying tissues. The constant accumulative stress against the appliance without any mechanical check forced the appliance against the underlying tissues, and Bonwell as early as 1890 designed the first mechanical check in the form of a simple lug or rest. This mechanical check tended to remove a great deal of the strain from the underlying tissues and placed it upon the abutment tooth. Another mechanical check was the Gilmore attachment, which consisted of a round-wire spring attached to a shell crown abutment with a ball tip at the opposite end. The appliance contained a corresponding groove which slipped over the round-wire spring, also availing itself of the clasp anchorage. This served as a greater mechanical check and placed considerable strain upon the abutments because it involved the principle of the lever, and has for that reason never enjoyed any particular vogue. Another more recent type of mechanical check is the Supplee attachment, which consists of sleeve and post, the one being attached to the shell crown or inlay, the other to the denture. This means of attachment also places a great deal of the strain upon the abutment, acting in the capacity of a short lever.

In the effort to obviate undue strain against the abutments on the one hand and prevent accumulative strain against the underlying tissues on the other, a series of modifications of the partial denture ensued having attachments which might be described as extra-coronal; that is, attachments for means of anchorages applied outside the periphery of the normal contour of the crown. The earliest of these is the Roach, which consists of a ball-and-socket joint, the socket being attached to the denture portion and the ball to the shell-crown abutment or an inlay. This ball-and-socket joint did not succeed in releasing the strain on the abutment tooth because of its unlimited movement, and because once more the attachment being on the outside of the normal anatomical contour acted on the principle of the lever. Roach has since modified his attachment in the effort to control the movement by flattening the sides of the ball and making possible its use either as an extra-coronal attachment or within the nor-

mal anatomical circumference. This modification is at least a tacit acceptance of the principle involved. Another effort to release the strain from the abutments, in effect a so-called stress-breaker, was designed by Dresch who, by means of his attachment, created a loose joint between the clasp and the appliance in an effort to comply with this principle. Even fixed bridgework has been influenced by this principle, resulting in a modification that demonstrated some effort to comply with it. Dr. Tinker is responsible for this modification, which consists of a small round-wire lug soldered to each end of the appliance that fits into an accompanying counter-sink within the inlay attachment. This permits of play and also facilitates the proper seating of the inlays. But again the play is unlimited and considerable stress is transmitted to the abutments.

The second part of this general statement, the relation of saddle design and saddle movement to the stimulation of underlying tissues, will be discussed under the heading of "bridgework and underlying tissues."

3. Interference with this yield or, in other words, the fixation of abutments, induces stasis and degenerative changes. It is true that comparatively little genuine investigation has been done to establish this point. Whatever has been done is either of a clinical or radiographic nature. Its principle is based upon the fact that mobility and function and circulatory stimulation are very closely inter-related and that fixation of any living organic unit would limit function, interfere with the normal circulatory stimulation, and result in a series of atrophic degenerative changes. In the broad sense, that principle is thoroughly accepted, for there is sufficient pathological evidence to verify the principle from a medical point of view. But thus far there has been very little opportunity to obtain actual microscopic evidence of such degenerative atrophic changes as would definitely show the effect of fixation upon the investing tissues of the teeth and the dental pulp. Clinically, careful observation shows evidence of general lack of tone at the free margin of the gum and hyperemic shadings in a greater or less degree. Patients have complained of a sensation of stiffness or numbness of such teeth as have been found to support fixed appliances. Radiographic investigation has also, up to the present, been very limited. Dr. Ottolengui presented a series of reports in

Dental Items of Interest some few years ago, from a number of investigators who had been radiographing abutment teeth of fixed appliances, in the effort to determine radiographic evidence of degenerative changes. The work on the whole was very sketchy and inconclusive, but it demonstrated the fact that some changes were present, which may or may not have been the result of fixation. A concerted investigation in that direction might yield a more satisfactory conclusion.

IV. BRIDGEWORK AND THE UNDERLYING TISSUES

The underlying tissues suffered a good deal in the early days of restorative dentistry. The partial clasp-denture without any mechanical check, as has already been indicated, dug its way into the soft tissues and the cumulative stress produced a condition which even today is designated as "settling of the gums." In fixed bridgework the accepted procedure, for esthetic purposes, was to scrape some of the model so that the pontics would be sure to jam their way into the tissue. With the partial clasp-denture, we have seen how the Bonwell lug has served as a mechanical check and tended to prevent the jamming of the denture into the tissues. With fixed bridgework too, considerable attention is being paid to this problem and scraping of the model has ceased. Finally Tinker, with his porcelain-tipped pontics lightly resting against the tissue, presented a means at least to prevent any irritation of the soft tissues.

In 1915 Dr. Chayes called attention to the fact that there was a need for stimulation of the tissues of edentulous spaces covered by appliances, and that this stimulation was to be effected in some way by the appliance. This idea at first attracted a good deal of ironic criticism, but today, after more than a dozen years of practical experience, it has gathered considerable momentum. The only ones who have placed any credence in the idea are those who have had a certain amount of experience with the application of the Chayes appliance, and also quite independently Dr. Hugh MacMillan, of Cincinnati, who has approached the problem from an entirely different angle.

From the positive point of view the saddle should be designed (a) to engage an extent of tissue-area similar to that engaged by the presence of the natural roots of the missing teeth; (b) and also to function with a degree of movement equal to the degree of compressi-

bility of the underlying tissues; (c) this movement to be effected during mastication by the exercise of stress buccally on the working side and lingually on the balancing side, thus tipping the appliance buccally and lingually to a degree controlled by mechanical relationship between the male and female attachments; and (d) the gingival tissues surrounding the abutment teeth not to be encroached upon.

The negative point of view is expressed by Burgess in the April, 1926 issue of *Dental Outlook*. On one hand, he generally denies the premise; on the other, contends that sufficient stimulation of tissues is effected by the play of attached muscles, in speaking, laughing, and mastication, and by massaging effect of tongue and cheek, passage of food bolus, thermal changes, and so forth. The negative point of view is summarized at greater length by Doxtater in the November, 1927, issue of the *Dental Cosmos*, in an article entitled "Saddle design and impression technique." This article is in the nature of a paternal reply to Anna Bruenn, and, the author says, "is written in the spirit of helpful criticism with no desire to enter into a controversy." Yet he immediately proceeds to put her across his knee and, in the old-fashioned way, spank her. The article in itself is full of contradictions. He says in part that, "with regard to the principles of movable removable bridgework, I take this opportunity to express my opposition to this type of work." Continuing, he says that "no removable bridge is entirely immovable when in place, nor can it be so constructed as to limit for more than a short time the independent movement of the abutment teeth. This movement may be nearly imperceptible to the naked eye but can usually be demonstrated. The rigidity of the fixed bridge is never quite duplicated, and the physiological needs of the abutment teeth will accordingly be served by other types of removable bridgework." Thus Dr. Doxtater seems to accept in the main the principles under discussion, but on the particular point in question, the stimulating effect of saddle portions, he says: "They do not and cannot stimulate nor is it desirable that stimulation should be applied to that portion of the jaw bone from which teeth have been removed and which is almost invariably healthy." To state that saddle portions cannot stimulate is one thing, but to state that stimulation is undesirable is quite another.

This question has received a good deal of consideration from Dr.

Hugh MacMillan, who has been for some time investigating the condition of bone underlying edentulous spaces. He has stated these conclusions:

(a) A lack of functional stimulation of the alveolar process of edentulous spaces results in disuse atrophy.

(b) The alveolar process has a very definite function after the loss of the teeth and responds physiologically to the stimulation of artificial restorations.

In a letter to Dr. MacMillan, calling his attention first to his conclusions, I then continued: "You go on to speak of the need for stimulation of alveoli by artificial restorations, but you make no mention as to whether in your observation certain types of artificial restorations have been more stimulating than others. As you know, we are called upon to use mechanical contrivances in permanently fixed relationship against the mucous membrane and the alveolar ridge. As far as I know, there is no such parallel in medicine unless it be the use of metal in connection with comminuted fractures. That, of course, is not a true parallel, because metal so used is not subject to the contact of external secretions or aerobic influences. Have you been able to formulate conclusions in relation to the degree of physiological tolerance against the fixation of metals used under conditions to be contended with in the oral cavity?" In his reply, he calls attention to his interest in the principles underlying Chayes appliances, and his desire to correlate radiographic findings of alveoli stimulated by a movable saddle with some of his recent histological findings, and adds: "But there is a lot of beautiful research work which could be done along this line. It seems to me that some of the money of the Research Council of the American Dental Association could well be spent on this problem." Accompanying his note, he calls attention to another of his conclusions published in the *Journal of Dental Research*, in December 1926:

"Functional adaptation of the alveolar process has been observed clinically under artificial appliances which are constructed in such a manner that physiological stimulation is applied. Obviously it is impossible to report upon the histological findings, but from digital and visual examination and by carefully directed roentgen ray, similar conditions are found which may be interpreted as having similar origin. It seems that there should be

more attention given to appliances which would seek to create this functional response of the alveolar process."

These conclusions of Dr. MacMillan are based upon very careful investigation of cross sections of alveolar bone, clinically, radiographically, and histologically examined.

On the matter of freeing the gingiva surrounding abutment teeth, Dr. Doxtater is again in disagreement, concluding that it is more important to seek stabilization of the saddle by covering the free margin of the gum and extending the saddle around part of the lingual surfaces of abutment teeth, but with some relief between it and the gingival crests. In that conclusion, I believe Dr. Doxtater stands generally unsupported.

V. BRIDGEWORK: ITS SCIENTIFIC APPLICATION; CONCLUSIONS

I have attempted to show that the first striving in reconstructive dentistry was merely the one of filling the edentulous space in such a way that it would be mechanically retained—without consideration of any of the fundamental hygienic or physiological needs. Three types of appliances were thus empirically employed, namely, the removable appliance, the clasp denture, and the fixed bridge. These three types of appliance have been basically retained, but have undergone a series of modifications in the effort to comply with the awakened consciousness in relation to (a) hygiene; (b) prevention of unnecessary injury and destruction of abutment teeth; (c) prevention of interference with the normal function of abutment teeth; (d) prevention of injury of the underlying tissues; and (e) provision of circulatory stimulation of the underlying tissues.

I have shown that the recognition of these principles constituted a transition from the empiric toward the scientific, whether the appliances in use at the present day are able to meet them or not. The principle of hygiene can be quite well met to-day by all appliances with the exception of those which perforce require the devitalization of abutments. Dr. Chayes called attention in 1915 to a yield as regards relationship between the tooth and the investing tissues, insisting that an interference with this normal yield interfered with normal function of abutment teeth, and with circulatory stimulation of the investing

tissues, resulting in disuse atrophy. At the same time Dr. Chayes also called attention to a need for circulatory stimulation of the underlying tissues.

With the promulgation of his principles, Dr. Chayes devised a system of universal application consisting of attachments which can conveniently be housed within the normal anatomical outlines of abutment teeth. These attachments consist of male and female parts: the female being housed within inlays constructed in cavities prepared according to the principles of Black: the male being attached to the appliance. With this system, Dr. Chayes introduced a paralleling device, the movement of which can be controlled to the thousandth of an inch by means of an actuating screw governed by tactile sense. By means of this instrument and accompanying mandrels, the attachments may be placed in recesses within the prepared inlays, with the final effect that the appliance does not exert any undue pressure against the abutment teeth. The provision of a yield in the relationship between the male and female parts facilitates normal mobility of the abutment teeth and the exercise of its normal function; and it also permits a slight movement of the saddle, thus causing a circulatory stimulation of the underlying tissues. This provision of yield in the relationship of the two parts of the attachment is now known as a stress-breaker, and most of the appliances now in use have been influenced by this principle.

It is quite well agreed that cavities have to be cut in vital teeth no matter what type of appliance is employed, including the clasp attachment. Thus Dr. Gillett, in an exhaustive consideration of the uses and application of the clasp, in the September (1927) issue of the *Journal of Dental Research*, says that "the stabilization elements devised in principle by Bonwell are preferably employed as lugs seated in recesses of definite shape in the body of inlays or fillings in teeth adjoining those supplied by the artificial appliance." Dr. Gillett is chiefly concerned, in his paper, with the application of a clasp which will tax, in the least amount, the tolerance of tooth tissues. To this end he advocates a round wire of specially tempered material to engage the tooth with the least amount of frictional contact. This type of clasp with the inlay supporting the mechanical check, and the stress breaker between the clasp and the appliance, represent the best

effort of the present day to conform to all principles enumerated, in that type of appliance. The fixed bridge in its present stage of development consists of inlay abutments with well rounded porcelain-tip pontics and wide inter-proximal spaces. A bridge of this type is however very difficult to seat properly, some compensation being required either by cutting more of the cavity or the cavo-surface of inlays in order to seat them, or to exert quite a good deal of pressure against the abutment teeth. The problem of seating a fixed bridge is fairly well solved, however, when a one-tooth restoration such as is used today, is attached only to one side with the lug loosely resting against the recess of the inlay on the other side. Another attempt to resolve this problem in larger restorations is the Tinker modification referred to, which also permits sufficient play to seat the appliance properly.

None of these types of fixed appliances however really serves all of the positive needs for the normal function of abutment teeth and the underlying tissues. They are all rather heavily tooth-bearing appliances and as such must necessarily transmit considerable stress to the abutments. At present it is my opinion, based upon an experience of twelve years' usage of the Chayes appliance, and after a comparatively brief experience with most of the types in common use, that the Chayes type of appliance best serves the fundamental principles involved. I do believe however that, in bilateral cases, some additional provision for the yield of the saddle portion itself, so that each side may function independently of the other, should be a little further developed. It may be interesting to mention that Dr. Charles Ash has attempted to extend this principle in recent years, and has utilized some rather complicated devices to accomplish such additional breaking of stress to bring about the circulatory stimulation of the underlying tissues.

Much has been said about carelessly constructed, slipshod appliances, made without regard to any of the principles here enumerated, and yet remaining in position over a period of years. I do not think it necessary to indulge in much comment in that direction. It is true that the tolerance in different people varies considerably. Thus Jack Dempsey can withstand pretty severe pummelling that might completely annihilate me. Our chief problem lies not in the maximum degree of tolerance of tissues, but rather in the minimum degree of

tolerance. This fact will best serve to standardize our reconstructive methods.

There remains but one other point to mention, and that is the criticism of expense and skill required for the construction of the presumably more involved technics. My own conclusions are that as soon as the patient realizes the necessity for an expense commensurate with the high degree of skill necessary for the construction of appliances best adapted for functional purposes from the standpoint of the least amount of tolerance, the more he will be concerned to care for his natural teeth and to prevent their loss. But it may be interesting to quote J. L. Williams once more, from his paper of 1883, in which, while summarizing his appreciation of the introduction of fixed bridgework at that time, he says: "But bridgework will never be extensively done; first, because of the expense; second, because of the degree of skill involved." We have traveled somewhat since that day.

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DISCUSSION

James K. Burgess, D.D.S. (New York City): I am thrice honored in being here tonight. First, this is my home society and I believe this is the first time that I have had the privilege of appearing before it. In the second

place, it is a real privilege to discuss so sane a paper as this by my friend Dr. Diamond. And in the third place, I have been chosen as a representative of the fixed bridge operators.

Dr. Diamond, wittingly or unwittingly, has paid me a very high compliment. In the note which accompanied the copy of his paper to me he said, "Treat me rough," and in the paper itself he referred to the fact I was supposed to wipe up the floor with him. I do not possess that ability, and if I did, I would not exercise it here tonight. Dr. Diamond's paper is a model of temperate presentation and discussion of the subject that is nearest to his heart, and to discuss it in any other manner and on any other basis would, to say the least, be ungenerous and unfair. There are many things in the paper that might be discussed, but in the light of the real crux of the whole matter I shall consider most of them side issues and not take up time with their discussion. Let me go immediately to the main point of the paper, which is based on the pronouncement made long ago by my good friend, Dr. Chayes, that "teeth move in function," and the system of bridge work based on that pronouncement.

Dr. Diamond has done me the honor to quote me quite freely, and I believe he has given fixed bridge work the fairest treatment it has received from any exclusive worker in removable dentures. If I were to be polite only, I should say: "The same to you, and many happy returns," and let it go at that. Dr. Diamond has also done me the honor to quote quite freely from a published paper of my own, and if I could be sure that you remembered verbatim these quotations, I should just leave them with you for your own analysis. But his paper is too good to be left in that fashion, and so I shall take it up a little more in detail.

The paper itself is a discussion of the type of bridge work for which Dr. Chayes is responsible, and its relation, or, as might be said, its opposition to certain other types of dentures which Dr. Diamond has described to you tonight: also the partial denture that is entirely a tissue-bearing appliance; the partial denture with lugs that remove at least a part of the stress from the tissues, and place it on the natural teeth; the clasp denture, and fixed bridge work. I am not going to say anything about the first three types of restorations, but I do want to speak briefly of fixed bridge work and see if I may not defend it, at least in some measure, against some of the things that are said and some things that are implied against it.

Let us take first Dr. Chayes' pronouncement that "teeth move in function." I think Dr. Diamond has misunderstood my attitude in this relation. I said in the very first paper I ever read on the subject, quoting from the poet: "Thou sayest an undisputed thing in such a solemn way." But

since that time it has become a disputed thing, and in the paper from which Dr. Diamond has quoted an account of a debate between Dr. Chayes and me, I said that, in opposition to Dr. Chayes' statement, there was evidence or at least a statement by Dr. Hopewell-Smith, to the effect that teeth do not move in function. But Dr. Diamond, I think, has confused my quotation of Dr. Hopewell-Smith's statement with my acceptance of that statement. I believe that teeth move in function. In the mouths in which I have occasion to restore lost teeth, the teeth surely do move in function, and most of them out of function.

Dr. Chayes has very evidently taken the normal as the basis of his studies and his conclusions. And so I want to start with the normal as my own basis. In order that we may all have the same view in our minds, I should like you to picture to yourselves the lower right side, we will say from the cuspid to the third molar, inclusive, with all of the teeth in their proper positions. It is not necessary for me to go into a detailed description of the parts; you are as familiar with them as I am. I will simply mention two or three items bearing on this particular part of the discussion. First, consider the coronal surfaces of the teeth, the occlusal surfaces where the actual load is placed and borne. Then, if you will, the conformation of the roots of the teeth, their placement in the bony sockets with the peridental membrane intervening, and each tooth in direct contact on its proximal sides with its fellow or fellows, as the case may be. Now, it seems to me, we can hardly conceive of the peridental membrane intervening between the root of the tooth and the socket of the tooth without granting to it some movement. It is a vascular tissue. It certainly has resiliency and there must, under the stress of mastication, be some compression of that membrane to allow for such movement. And since the peridental membrane is not removed for fixed bridge construction, it is equally inconceivable that this movement is not operating under the fixed bridge as under other types of construction. But what I have said, and what I repeat is that the nearer we come to the normal or the ideal in the condition of the peridental membrane, the less movement there is because in the well developed, well organized denture these tissues are all firm and secure, so that the nearer we get to the normal the firmer is the membrane, the less the resiliency, the less the compression under stress, and consequently the less the movement of the tooth under stress.

In order that we may consider the subject fairly and analyze the statement, "teeth move in function," we must know not only something of the teeth, but something of the function itself. I have described as much as seems necessary of the teeth and their relations. Next I want to analyze

the masticatory function as consisting of the retreat, by which I mean the opening of the jaws through the lowering of the mandible, and the attack, which comprises the drive, the impact, and the excursion. By the drive, I mean the movement of the jaw from its furtherest position away from the opposite jaw toward the nutrient mass between the teeth. The impact is the moment of contact with the nutrient mass, when it is placed under compression between the occlusal surfaces of the teeth, and the excursion is the lateral movement of the jaws by which the nutrient mass is actually ground and comminuted. You will realize that in the work of grinding, the occlusal surfaces of the teeth are not brought into contact with themselves, but against the opposing sides of the nutrient mass. In that act the teeth are compressed downward and upward, as the case may be, in their sockets. And I believe that in this first act of compression, the teeth in the opposing jaw are forced to the limit of the compressibility of the peridental membrane into their sockets, and that practically all the movement of the teeth in their sockets occurs during this stage of the act of mastication. This leaves certainly very little of the lateral movement of the teeth to be invoked under the excursive movement of the mandible, because the teeth remain under direct compression during the excursive movement.

Now let us take the same jaw, remove the second bicuspid and the first molar, allow for the resorption of the bone, the rounding up of the process, and the establishment of what I have always called a finished condition—the condition in which we like to see these tissues before we start the work of restoration. In this condition, the teeth having been extracted, the rigidity of the contact points between the second molar and the third molar, and between the first bicuspid and the cuspid, has been somewhat diminished, and the contacts on the mesial side of the second molar and the distal side of the first bicuspid entirely removed, so that the stability of the remaining teeth has, to that extent, been interfered with. Under these circumstances it is natural to suppose that there will be more lateral movement of the teeth in the work of mastication. Now, take the same case and put in a removable bridge such as Dr. Diamond has described. He describes the attachments as consisting of male and female portions, and the saddle as being spread out to engage the area of mucous tissue which is involved, as he believes, in the work of mastication through the movement of the teeth in their sockets, and being thus engaged, is stimulated by that act. The male portion of the attachment, as I understand it, must rest on the bottom of the base of the female portion, so that there is no vertical play in the attachments. The saddle portion must occupy one of three relations to the gum tissue. It must occupy a position out of contact with the gum

tissue, in which case all of the stress of mastication will be on the two abutment teeth—granting that we are using only two—just as would be the case in fixed bridge work; or, it must rest on the mucous tissue under compression, which would bring about strangulation and exactly the condition that Dr. Diamond has condemned, and that all thinking men condemn in any type of structure; or it must occupy a relation of contact without pressure, which I believe is the relation it is intended to occupy.

Dr. Chayes has hoped by this type of restoration, and the relations that it occupies to the tissues, to accomplish the work of mastication with entire independence of the molar, we will say, from any stress which may be brought in the bicuspid region of the bridge. In other words, my understanding is that the whole design of the attachment is to give each tooth its own independence of movement. Dr. Diamond has already quoted what I have to say on that subject, and it scarcely needs repetition beyond the restatement that if it is possible to do it, it certainly is a very delicate operation, and frankly, I do not believe myself able to accomplish it.

Then comes the action of the saddle portion under the stress of mastication. Dr. Chayes believes that the movement of the teeth in their sockets, in such a case as we are supposing, previous to their extraction has stimulated the mucous tissues about those teeth. Whether that be so or not, I certainly cannot believe that that is one of the things designed to be accomplished by such movement. There are many other forces which Dr. Diamond has already enumerated to produce that stimulation of tissue, to the extent required for its maintenance in a state of health. But it is almost inconceivable to me that, if the movement of the teeth in their sockets does stimulate these tissues about the teeth, it could possibly do so to the limits of the periphery of the saddle as designed in such specimens of movable removable bridge work as I have seen. It seems to me that, with this saddle in the rest position against the tissues and the male portions of the attachment resting in the bottom of the female portions, these abutment teeth will, under stress of mastication, get the same degree of compression that was normal to them while the teeth now lost were in the mouth. And if that be the case, it would seem that this compression of the teeth in their sockets will give the same degree of compression to the tissues under the saddle as that induced by the movement of the abutment teeth, and that in consequence, whatever stimulation is brought to these tissues as the result of the movement of teeth in their sockets will be induced without the additional movement which Dr. Chayes describes as being given to the saddle. In the movement of the saddle, as it seems to me, more stimulation, considerably more, has been provided for than was normal to those tissues

in their original state. I do not say that this is a particular disadvantage, because as Dr. Chayes assures me, and Dr. Diamond as well, the tissues under these saddles remain in a perfectly healthy condition. But I am calling attention to the fact that the promulgators and the advocates of this type of bridge work are sticklers for function, and the rights of the tissues are the basis of function. And I cannot give my consent to the idea that "function plus" is any less a violation of tissue rights than "function minus." Within reasonable limits neither disturbs me very much, because I accept all of these deviations from the normal as penalties for the loss of the teeth and we must always pay the penalty wherever we are subjected to any deviation from the normal.

If I were not reminded that I am talking over long I should say something more about modern fixed bridge work, but Dr. Diamond has given you a hint of this in paying his compliments to Dr. Tinker and his particular type of bridge work. He has made acknowledgement, from the sanitary point of view, that it complies with the requirements. I think that it also can be shown that, from the engineering point of view, fixed bridge work has been brought to a stage where it fulfils the functional demands.

Dr. Diamond (in conclusion): I had hoped that Dr. Burgess would confine himself to a discussion of my criticism of fixed bridge work. I wanted those points which I had raised answered for my benefit as well as, I am sure, for the benefit of every one here—particularly the question of setting the fixed bridge. He made no mention of that at all.

I had also hoped that he would in some way try to point out that the fixed bridge does not interfere with the individual mobility of the abutment teeth. Instead, he tried to explain in a very capable manner that the type of appliances we advocate also limits the function through limitation of the individual mobility of teeth, and that it is necessary in some way, no matter what type of appliance is used, to limit such movement. At the same time he confessed very frankly that he knew practically nothing about the use of the particular appliances which we are advocating.

I used the fixed appliance for a considerable period of time, and discarded it only because, in my opinion, that appliance did not serve my particular needs. I remember having some discussion with Dr. Burgess in Buffalo in relation to the practice of bridge work, and at that time I very definitely and pointedly asked him, merely for the purposes of his own experimentation to construct an appliance of the type that I advocate, and then to observe its particular results. I even offered at that time to assist him in constructing such an appliance. Up to the present time he has not availed himself of, may I say, this opportunity.

WILLIAM J. GIES FELLOWSHIP IN BIOLOGICAL CHEMISTRY AT COLUMBIA UNIVERSITY

FREDERICK G. GOODRIDGE, *Chairman*, and PAUL E. HOWE, *Secretary*, *General Committee;* WILLIAM B. DUNNING, *Chairman*, and LEUMAN M. WAUGH, *Secretary*, *Dental Committee*

A year ago we published an announcement that "the income from the [Gies Fellowship] Fund—approximately $1000 for the academic year 1927–28"—was then available and that the First Fellow was about to be appointed.[1] By the terms of the gift to the University, as stated in that announcement, only 50 per cent of the net income per year may be expended during the first ten years after the establishment of the Fellowship, and "all unexpended income shall be added to the principal." Under these conditions, the sum available for direct payment to the Fellow in each semester of 1927–28 was $250. The nomination could not be made before the end of the first semester, however, when Dr. James M. Inouye, a member of the staff of the Biochemical Department, was appointed First Fellow for the remainder of the academic year to complete a research on salivary mucin that had been begun previously at Dr. Gies' suggestion. His findings will be published in an early issue of this *Journal*.

For the year 1928–29, Theodor Rosebury, D.D.S. (Pennsylvania, 1928) has been appointed Second Fellow. He is now engaged in advanced work in preparation for a career of teaching and research in dentistry, and is also conducting a study in the Biochemical Laboratory on the nature of the protein in dental enamel and allied problems.

It is a great pleasure to announce that Dr. Louise C. Ball, a candidate for the Ph.D. degree in the Department of Biological Chemistry in 1914 and 1915, has given to the Central Union Trust Company of New York City, in trust for the Fund, the sum of $10,000, the income

[1] Goodridge, Howe, Dunning, and Waugh: *Journal of Dental Research*, 1927, vii, p. 530.

therefrom, at 5 per cent beginning in November 1928, to be paid quarterly by the Bank to Columbia University and added to the amount awarded directly to the then incumbent Fellows. Dr. Ball reserves the right, in the event of personal disability or other personal emergency, to suspend one or more of these payments, but has provided that in the event of her death during their continuance, the income shall be paid in perpetuity to the incumbent Fellows. The income from this gift will be approximately $300 for the remainder of the present academic year and $500 annually thereafter.

That portion of the income of the Fellowship for the current year from both funds which is payable directly to the Fellow will be increased by anonymous donors to a total of $1200. Anonymous donors have agreed to supplement the available income next year (1929–30) by amounts sufficient to make the sum payable directly to the Fellow equal to at least $1500.

Suggestions of candidates for the Fellowship in 1929–30 should be presented to Dr. Gies in the Biochemical Department of Columbia University, 632 West 168th Street, before May 1, 1929. Dr. Gies, during the remainder of his active career, will nominate the Fellows. He has indicated his intention to accept this privilege as an opportunity annually to promote teaching and research in dental schools.

We present below a register of the names of all of the contributors to the fund, with a financial summary. Contributors who may wish to ascertain whether the amounts of their payments have been correctly entered on the records are invited to address inquiries to the Treasurer of Columbia University, 60 Wall Street, New York City. Any errors that might have occurred will be noted in future reports.

REGISTER OF CONTRIBUTORS TO THE WILLIAM J. GIES FELLOWSHIP FUND IN BIOLOGICAL CHEMISTRY AT COLUMBIA UNIVERSITY

A. Contributors who made payments to the original Biochemical Committee (April 1923—January 1924, inclusive): Group I

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Arnold K. Balls
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Total amount of the contributions by Group I $8,993.75

B. Contributors who made payments to the Joint Biochemical and Dental Committees (since February 1, 1924): Group II

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American Academy of Dental Science
American Dental Association
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Edward Kennedy
Kings County Dental Society, New York
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* One of the members of the Dental Faculty of Columbia University, who collectively contributed One Thousand Dollars ($1,000).

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Louis E. Wise
George H. Wright
J. Lowe Young

Total amount of the contributions by Group II $13,063.03

* One of the members of the Dental Faculty of Columbia University, who collectively contributed One Thousand Dollars ($1,000).

C. Contributors to the "Special Research Fund" of the Biochemical Department of Columbia University before January 1, 1923 (unexpended balance transferred to the Fellowship Fund, with the consent of the surviving donors, July 1, 1927): Group III

Robert Abbe
H. M. Adler
J. R. Alvarez
Hugh Auchinloss
George Baehr
L. B. Bangs
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Christian Bear
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Linsly R. Williams
Francis C. Wood
H. F. Ziegel

Total amount of the unexpended balance of the "Special Research Fund" (created by Group III) that was transferred to the Fellowship Fund	$2,696.84

D. Financial summary

Amount of contributions by Group I (April 1923–January 1924)			$ 8,993.75
Amount of contributions by Group II (February 1924–June 1928)			13,063.03
Amount of contributions by Group III (Biochemical Research Fund: unexpended balance)			2,696.84
Total amount of the contributions to June 30, 1928			$24,753.62
Income—Interest received by Columbia University:			
June 30, 1924	$ 207.28		
June 30, 1925	645.30*		
June 30, 1926	593.28		
June 30, 1927	755.51		
June 30, 1928	1,186.64	$3,388.01	
Expenditures:			
Expenses of the original committee	$ 504.57		
Award to the First Fellow, second semester, 1927–28	250.00	754.57	2,633.44
Total amount of the Fund held by Columbia University, June 30, 1928			$27,387.06
Amount of the Trust Fund recently established by Dr. Louise C. Ball in behalf of the Fellowship			10,000.00
Total amount of the Funds invested for the support of the Fellowship			$37,387.06

* Includes interest, on a Liberty Bond, that was earned chiefly in 1923–24.

E. Estimated income of the Fellowship in 1928–29

Interest on the Fund held by Columbia University: $1,369.35. Of this amount, one-half will be added to the principal sum—the other half to be paid to the Fellow....	$684.67
Interest on the Trust Fund established by Dr. Louise C. Ball (amount for the remainder of 1928–29).....	300.00
Interest on contributions received since June 30, 1928, and gifts by anonymous donors.....	215.33
Total amount payable to the Fellow.....	$1,200.00

It is the earnest hope of our Committees that the Fund may be increased to yield an annual income that would be a suitable stipend for teachers who, on yearly leaves of absence from their schools, could, by appointment to this Fellowship, be given exceptional opportunity at Columbia to improve their teaching, to acquire broader facility in research, and to contribute to the advancement of learning.

Additions to the Fund should be made payable to the Treasurer of Columbia University, but may be sent to any member of the Committees, or to any officer of the Biochemical Department of Columbia University.

New York City and Washington, D. C.
October 31, 1928

SUPPLEMENT[1]

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I. First District Dental Society of the State of New York

Excerpt from the Annual Report of the Executive Committee in April, 1928

Martin Dewey, E. P. R. Ryan, and Alfred Walker, Committee

The plan for the general meetings of the Society which was adopted for 1927–28 was in part inspired by the Report of the Carnegie Foundation on Dental Education (Bulletin No. 19). In this report, Dr. Gies brought out the importance of acquainting the public with the present status of dental science, and the need for advancing knowledge in this field through research. It was the belief of this committee that meetings addressed by prominent laymen would be of interest both to the dental profession and the public, and that the reports of messages so delivered would find a conspicuous place in the lay press. This object was attained to a high degree. Men prominent in public life have become interested in the relation of dentistry to the general welfare and have given us their thoughts on this phase of our work. Moreover, through these meetings we have established contacts with the press with the result that much valuable space in our

[1] The notes on the proceedings of societies have been presented by the editors representing the respective organizations.

best newspapers has been given over to reports of meetings and discussions of matters relating to the teeth. In spite of the fact that most of the general meetings of the Society have been given over to this type of address, the membership has not been deprived of the advantages of the scientific and technical programs. Through the policy of abolishing dues for the sections and opening the attendance at section meetings to the entire membership, all members have had ample opportunity to attend meetings devoted to the purely scientific and technical phases of dentistry.

The committee feels gratified at the support that the Society has given by its attendance at the general meetings. The future will tell, even more than the present, the good which has been accomplished by them. It is to be hoped that we may in the future maintain the valuable contacts with the lay press which have been established this year.

In addition to the scientific programs of the sections, much valuable material of a technical nature was provided at the third annual Better Dentistry Meeting in December (1927). This meeting has proved itself to be an outstanding feature of the season's work of the Society, as indicated both by the interest exhibited and the increased registration from year to year. Attention is called to the fact that the Better Dentistry Meeting is the outgrowth of the efforts of our incoming president, Dr. Armin Wald, who inaugurated this policy in a special one-day meeting held in March, 1925. It may be announced at this time that the committee on the Better Dentistry Meeting for 1928 is already formulating its plans, with the idea of making this meeting even more interesting than those held in the past. It is gratifying to note that the Better Dentistry Meeting has attracted the attention of other dental societies. The New York State Society and others outside the state have adopted, for instance, the Topic Discussions for their programs, a feature which originated in our district. Not the least pleasing feature of the Better Dentistry Meeting was the testimonial dinner in honor of our past president, Dr. William Dwight Tracy. This dinner, given by the First District Dental Society, will go down in history as one of the most successful events of its kind ever held.

II. New York Academy of Dentistry

Notes from the minutes of the proceedings in 1927–28

Malcolm W. Carr, D.D.S., Editor

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Activities Bureau: Charles F. Bödecker, William J. Gies, Arthur H. Merritt, Edwin J. Nestler, Leuman M. Waugh, George S. Callaway, Secretary, Bissell B. Palmer, Jr., Chairman.

SCIENTIFIC MEETINGS

During the season of 1927–28, the New York Academy of Dentistry held six regular meetings and one special meeting. They were held at the Commodore Hotel, New York City, and were preceded by informal dinners.

October. Foster Kennedy, M.D., of New York City, addressed the Academy on "Facial pain."[2] Discussion of the address was opened by Charles A. Elsberg, M.D., of New York City.

William J. Gies, Ph.D., of Columbia University, New York City, Chairman of the Research Council of the Academy, presented an abstract of the Council's first public report of "Studies of the validity of advertised claims for dental industrial products."[3]

[2] Kennedy: *Journal of Dental Research*, 1928, viii, p. 183.

[3] The findings in this first public report were published in the *Journal of Dental Research*, 1927, vii, p. 477.

November. A series of progressive clinics were held as follows: "Dental medicaments, care, use and application in every day practice," by Dr. James E. Aiguier, University of Pennsylvania, Philadelphia. "Inlay preparations and castings," by Dr. A. B. Hall, Columbia University, New York City. "The indirect inlay and its application to fixed bridgework," by Dr. Albert J. Irving, New York City. "Local anesthesia, its use by the general practitioner," by Dr. Leo Stern, New York City. "Various suggestions in operative technic," by Dr. William D. Tracy, New York City.

December. A joint meeting was held with the New York Section of the International Association for Dental Research. F. V. Simonton, D.D.S., University of California, addressed the meeting on "The most significant findings of the California Stomatological Research Group in the study of pyorrhea."[4] The discussion was opened by Arthur H. Merritt, D.D.S., and continued by Isador Hirschfeld, D.D.S.

January. Sherman L. Davis, M.D., A.M., Ph.D., Indianapolis, Indiana, addressed the Academy on "The relation of nutrition to general immunity."[5] The discussion was opened by Arthur F. Coca, M.D., Professor of Immunology, Cornell Medical College, New York City.

February. Russell W. Bunting, D.D.S., University of Michigan, presented a paper entitled: "The rôle of Bacillus acidophilus as it relates to dental caries."[6] The address was illustrated by lantern slides and included a report of Dr. Bunting's latest researches upon this subject. The discussion was opened by J. Leon Williams, D.D.S.,[7] New York City and continued by Charles F. Bödecker, D.D.S., Columbia University, New York City.

Dr. Bödecker also read a short essay entitled: "Bacterial destruction of dental enamel."[8] Leuman M. Waugh, D.D.S., Columbia University, discussed this paper.

March. The third annual series of progressive table clinics was

[4] Simonton: *Journal of Dental Research*, 1928, viii, p. 235.
[5] The paper has not yet been published.
[6] The author has not submitted a manuscript for publication.
[7] Read by Dr. Leuman M. Waugh.
[8] The manuscript has not been prepared for publication.

presented as follows: "Method of securing dental cultures and smears," by Dr. Joseph L. Appleton, Jr., University of Pennsylvania, Philadelphia. "Cavity preparation and manipulation of gold foil," by Dr. Leroy L. Hartman, Columbia University, New York City. "Cavity preparation and impression for the porcelain inlay," by Dr. William J. Meier, New York City. "Various suggestions in prosthetic technology," by Russell W. Tench, New York City.

April (*annual meeting*). Reports of officers and committees were presented. The following officers were elected for the ensuing year: *President*, Arthur H. Merritt; *Vice-president*, Leuman M. Waugh; *Secretary*, S. E. Davenport, Jr.; *Treasurer*, Alfred L. Kohn; *Editor*, Malcolm W. Carr.

Five Associate Fellows, Drs. George M. Babbitt, John O'Gorman Lane, Francis S. McCaffrey, Leo G. Pollock, and Edwin G. Van Valey, were elevated to active fellowship in the Academy in recognition of achievement and distinction in professional activities.

Dr. Leuman M. Waugh, New York City, presented an address, illustrated by colored lantern slides and motion pictures, entitled: "An adventurous cruise to Northern Labrador."

BANQUET

A testimonial banquet, under the auspices of the New York Academy of Dentistry, was tendered to Dr. Sebert Ellsworth Davenport, on April 21, at the Waldorf-Astoria in New York City, in recognition of his long and inspiring service to the dental profession. Dr. Arthur H. Merritt, President of the Academy, introduced Dr. William D. Tracy, as Toastmaster, who presented the following speakers: Dr. William Rice, Dean, School of Dentistry of Tuft's College, on "Dr. Davenport: the man and his influence;" and Dr. William B. Dunning, New York City, on "His influence on professional journalism." Responses were made by Dr. Davenport and Mrs. Davenport.

RÉSUMÉ OF EXECUTIVE PROCEEDINGS

At the November meeting, the following resolutions and memorial were unanimously adopted:

"Whereas, it has pleased Divine Providence to call to eternal rest our colleague and friend, Doctor CHARLES J. BROPHY; and

"*Whereas*, Dr. Brophy had attained a distinguished place in our profession as a teacher, organizer, and practitioner; and,

"*Whereas*, we recognized and were edified always by his industry, his personal attributes, and his high professional conduct; therefore, be it

"*Resolved*, that the New York Academy of Dentistry record its sorrow in the passing of this esteemed brother from our profession; and, be it also

"*Resolved*, that the New York Academy of Dentistry extend to Mrs. Charles J. Brophy and family the deep and earnest expression of its sympathy in their bereavement."

Committee { William B. Dunning
John O'Gorman Lane
Henry W. Gillett, Chairman.

"*Whereas*, the death of our friend and fellow member, Doctor HOLMES C. JACKSON, in the height of a career of notable achievement, is an event sad to this Academy, as it is deplorable in this community; and

"*Whereas*, Doctor Jackson's services in the fields of experimental science and of dental education were of distinguished and recognized worth; and

"*Whereas*, as the first dean of the New York University Dental College, Doctor Jackson performed most happily the difficult task of reorganizing an independent institution of teaching upon a university basis; now, therefore, be it

"*Resolved*, that the New York Academy of Dentistry records hereby its sorrow in the passing of Dean Jackson from this life; and, further

"*Resolved*, that the Academy inscribe this memorial in its minutes and express to Mrs. Jackson the sincere sympathy of its members in her great sorrow."

Committee { William B. Dunning
John O'Gorman Lane
Henry W. Gillett, Chairman.

"Died September 1, 1927, FRANK THORN VAN WOERT, M.D.S., M.D., Charter Fellow of the New York Academy of Dentistry, Professor of Dentistry, member of the Administrative Board and recently Director of the School of Dental and Oral Surgery of Columbia University, outstanding leader of dental opinion and activity.

"It is with deep sorrow that the New York Academy of Dentistry records the passing, from its ranks and counsels, of this valued Fellow.

"His sterling integrity, his manifest determination to think rightly, to speak fairly, to constantly advance the standing of his profession, and to

deal courageously but courteously with all in so doing, were among his notable qualities.

"His constant readiness to counsel and help the younger members of his profession was of inestimable value to many such in their developmental years.

"His exceptional capacity in executive detail has borne fruit in his later years in the educational field, and there, as in practice, in clinical service, and in the counsels of organized dentistry, he has left a shining record of achievement, one that gains additional lustre from the fact that his professional education was gained in spite of obstacles that might well have daunted a man of lesser qualities.

"With chastened spirit, we enter on our records the passing of a dear friend and counsellor, whose record of over fifty years in our calling challenges emulation.

"By unanimous vote on November 28, 1927, the New York Academy of Dentistry directs that the above memorial be entered upon its records, and that its officers shall transmit copies to the family of Dr. Van Woert and to leading dental journals with request for their publication."

Committee { William B. Dunning
John O'Gorman Lane
Henry W. Gillett, Chairman.

The work of the Activities Bureau, which was established a year ago for the purpose of engaging Associate Fellows in various professional activities,[9] has progressed and has become one of the important activities of the Academy. Each of the Associate Fellows has been asked to signify the particular professional activity with which he would like best to become identified, being given the choice of teaching, writing, organizing, or research. It is the aim of the Academy to engage each man in the particular work for which he may have been trained, or for which he may have a special tendency, thus not only guiding the individual into some branch of useful professional service, but also giving the profession itself support from the efforts of trained men in the activities upon which the profession is founded.

The Research Council,[10] which by research ascertains the correct-

[9] The resolution which established the Activities Bureau was published in the *Journal of Dental Research*, 1927, vii, p. 509.

[10] Reference to the establishment of the Research Council may be found in a resolution published in the *Journal of Dental Research*, 1927, vii, p. 509.

ness and accuracy of advertised claims of manufacturers of dental products, has published its first public report[11] dealing with "Taxi" and "Stain Remover."

Dr. Charles F. Bödecker has been elected to the Research Council to fill the place left vacant by the resignation of Dr. Alfred Owre. The successor of Dr. Holmes C. Jackson, deceased, has not yet been appointed.

The official seal (*fig. 1*) of the New York Academy of Dentistry was approved and unanimously adopted at the February meeting. The report of the Seal Committee, which is descriptive of the symbolisms contained in the seal, is included in this résumé by a motion made at the time of its adoption.

"The Seal of the New York Academy of Dentistry"

"The fundamental principle upon which a seal is designed is that the seal should embody the ideals of the institution or academy which it represents, artistically arranged in some symbolic manner.

"One needs but to review the first paragraph of the by-laws of our academy to determine the ideals upon which the New York Academy of Dentistry was founded. The first paragraph of Article II (Object), states that: 'The object of the Academy shall be to uphold the dignity and honor of the dental profession, exalt its standards, extend its sphere of usefulness and promote the advancement of dental science. It shall further be the object of the Academy to encourage and develop professionally controlled journals for the publication of dental literature, elevate the standards of dental education, and exert its influence toward placing the activities of the profession and its members upon the highest ethical and non-commercial plane.'

"We find, therefore, that one of the principal objects of the Academy is *to encourage.* The Bureau of Activities was founded for the purpose of encouraging Associate Fellows to become interested in some special branch of professional service, and as recognition of distinguished service in teaching, investigating, writing, or organizing, Associate Fellows may be elevated to Active Fellowship. That the Academy stands for encouragement of truth is represented well by the organization and activities of the Research Council. Therefore, the motto consists of the three Latin words, *hortatio, excelsior, veritas,* which when translated mean encouragement,

[11] *Journal of Dental Research,* 1927, vii, p. 477.

onward and upward, and truth. *Excelsior* is placed in the chief central position and is used as an expression of sustained aspiration (ever onward and upward), based upon and supported by *hortatio* on one side and *veritas* on the other.

"The central figure of the seal is a representation of a Grecian temple, designed in the classic Ionic style of architecture, which symbolizes the Temple of Idealism, as is represented by the Latin word *perfectus*, inscribed along the architrave of entabulature. As the Parthenon at Athens was built as an epithet to Minerva, so our temple has been conceived as an epithet to the ideals for which this Academy stands.

FIG. 1

"The pathway leading up to the temple is the Pathway of Progress, and along the pathway leading to the Temple of Idealism are the Latin words, *eruditio*, *investigatio*, and *acta publica*, which represent the three greatest professional activities in which the Academy is interested, and which it strives to place upon a basis of idealism.

"That teaching, investigating, and journalism, are considered of chief importance in the progress of dentistry, and in the ideals of our Academy, is made certain by frequent allusions to this fact in various sections of the by-laws: The second paragraph of Article II states that 'a special fund, known as the Advancement Fund, shall be set aside and kept separate from the general funds of the Academy. The use of this fund shall be restricted primarily to the furtherance of a dental or medico-dental building, equip-

ment or maintenance of a dental or medico-dental center, dental research laboratories, dental libraries, clinics, or dental educational institutions; or in general to activities conforming to the objects of the Academy as stated in paragraph 1 of this article.' The second paragraph of Article III (Fellowship), states that 'Active Fellows shall be ethical members of the dental or allied professions and shall be further qualified by having been actively identified with the progress of dentistry. This activity shall have been in writing, investigating, teaching, or organizing.'

"The official name of this organization and the year of incorporation represented in Roman numerals, form the outer circumference and complete the seal."

Committee { Sebert E. Davenport, Bissell B. Palmer, Jr., Malcolm W. Carr, Chairman.

III. International Association for Dental Research

Memoranda on the Proceedings in 1927–28[12]

William J. Gies, F.A.C.D., Secretary

Sixth Annual Meeting

The sixth annual meeting of the International Association for Dental Research, held at the Hotel Mayflower in Washington, D.C., on March 25–28, 1928, was the best attended and most successful in the history of the Research Association. The chairmen at the sessions were Drs. Leroy M. S. Miner, Harvard University, President, and R. W. Bunting, University of Michigan, Vice-president. To prevent confliction with the program of the coincident annual meeting of the American Association of Dental Schools, at the same hotel, sessions of the Research Association were convened only in the afternoon and evening of March 25, in the evenings of March 26 and 27, and in the afternoon of March 28.

[12] A brief outline of the organization and early development of the International Association for Dental Research, including the Constitution, was published on pages 197–208 of this volume of the *Journal of Dental Research* (viii, 1928). This was followed by a summary of the proceedings of the general meetings from 1920 to 1927, inclusive, with a register of the membership as of March 15, 1928 (pages 209–233). A record of the executive proceedings of the general meetings before 1927–28 will be published in the next volume of the *Journal of Dental Research* (1929, ix).

Abstracts of the forty-seven scientific communications were published on pages 395–461 of this volume (*Journal of Dental Research*, viii, 1928).[12]

The officers and new members, elected at this meeting, are listed on pages 461–464 of this volume, and are included in the appended register. There are now 153 members.

SECTIONS

The sections in existence at the date of the last annual meeting were those in Ann Arbor, Boston, Chicago, New York, San Francisco, and Toronto. Since that meeting, additional sections have been organized successively in Pittsburgh, St. Louis, Halifax, Minneapolis, and Philadelphia.

During 1927–28, meetings of sections were held on this schedule: *Ann Arbor*—None; *Boston*—October 4, November 9, February 10; *Chicago*—October 13, November 17, January 23, April 10, May 25, June 20; *Halifax*—April 17, May 2, May 22, June 29; *Minneapolis*—May 2; *New York*—December 14, February 29; *Philadelphia*—June 6; *Pittsburgh*—March 30, March 31; *St. Louis*—April 11, May 9, June 13; *San Francisco*—December 14; *Toronto*—November 21, February 6.

Proceedings of sectional meetings have been published in this volume of the *Journal of Dental Research* (viii, 1928, pp. 7 and 613), and will also be presented in succeeding volumes.

NEXT ANNUAL MEETING

The seventh annual meeting will be held in Chicago, March 23 and 24, on the two days immediately preceding those of the next annual meeting of the American Association of Dental Schools. The scientific sessions are open to visitors.

REGISTER OF MEMBERS AND OFFICERS: NOVEMBER 15, 1928

Members

1. *Ann Arbor Section.*—R. W. Bunting, Faith P. Hadley, C. J. Lyons, **U. G. Rickert*, E. O. Scott, M. L. Ward.

2. *Boston Section.*—L. W. Baker, **F. R. Blumenthal*, W. G. Bridge, F. P.

* Secretary of the Section.

Chillingworth, H. DeW. Cross, Adelbert Fernald, C. E. Hatch, P. R. Howe, E. A. Hooton, A. L. Johnson, V. H. Kazanjian, P. A. Leavitt, L. M. S. Miner, A. L. Morse, F. W. Morse, William Rice, A. P. Rogers, Benjamin Spector, K. H. Thoma, Harry Trimble, G. H. Wright.

3. *Chicago Section.*—Lloyd Arnold, William Bebb, Olaf Bergeim, A. D. Black, J. R. Blayney, D. J. Davis, T. L. Gilmer, E. H. Hatton, H. A. McGuigan, F. B. Moorehead, Emil Mueller, A. C. Nichols, F. B. Noyes, V. T. Nylander, **B. Orban*, W. F. Petersen, H. A. Potts, B. O. Sippy, W. G. Skillen, N. G. Thomas, W. H. Welker.

4. *Halifax Section.*—J. S. Bagnall, A. W. Faulkner, W. G. Dawson, W. C. Oxner, S. G. Ritchie, R. P. Smith, **G. K. Thomson.*

5. *Minnesota Section.*—E. S. Best, I. A. Epstein, B. S. Gardner, C. J. Grove, H. A. Maves, F. S. Meyer, G. S. Monson, W. D. Vehe, C. W. Waldron, **D. E. Ziskin.*

6. *New York Section.*—Adolph Berger, Theodor Blum, C. F. Bödecker, L. A. Cahn, M. W. Carr, H. E. S. Chayes, G. W. Clapp, H. S. Dunning, W. B. Dunning, J. D. Eby, W. J. Gies, H. W. Gillett, W. K. Gregory, Milo Hellman, R. G. Hutchinson, Jr., T. P. Hyatt, J. M. Inouye, V. H. Jackson, F. C. Kemple, Maxwell Karshan, Frances Krasnow, H. J. Leonard, J. O. McCall, F. S. McKay, A. H. Merritt, E. G. Miller, Jr., H. F. Osborn, Alfred Owre, **B. B. Palmer, Jr.*, J. P. Ruyl, M. I. Schamberg, P. R. Stillman, L. M. Waugh, B. W. Weinberger, J. L. Williams, J. L. Young.

7. *Philadelphia Section.*—J. L. T. Appleton, Jr., **Carrie K. Bryant*, J. A. Detlefsen, R. H. Ivy, Joseph McFarland, J. V. Mershon, W. R. Pentz, Hermann Prinz, A. Hopewell-Smith, C. R. Turner.

8. *Pittsburgh Section.*—T. W. Brand, Kaethe W. Dewey, F. C. Friesell, H. E. Friesell, W. F. Swanson, **L. E. Van Kirk*, W. H. Wright.

9. *St. Louis Section.*—B. E. Lischer, E. B. Owen, **C. O. Simpson*, G. B. Winter.

10. *San Francisco Section.*—G. L. Bean, J. A. Marshall, E. H. Mauk, G. S. Millberry, F. H. Orton, **J. S. Shell*, F. V. Simonton.

11. *Toronto Section.*—J. F. Adams, G. R. Anderson, H. K. Box, A. J. Broughton, Thomas Cowling, **W. E. Cummer*, A. W. Ellis, C. J. Fraser, Andrew Hunter, F. C. Husband, A. J. McDonagh, E. W. Paul, H. S. Thomson, W. C. Trotter, A. E. Webster.

12. Not yet members of a section: *Baltimore.*—E. V. McCollum. *Cleveland.*—S. W. Chase, F. C. Waite. *Indianapolis.*—S. L. Davis. *Iowa City.*—A. W. Bryan, R. H. Volland. *Louisville.*—T. B. Beust. *Rochester.*—Philip Jay. *Washington, D. C.*—F. E. Rodriguez.

* Secretary of the Section.

Officers: 1928–29

President—Leroy M. S. Miner, Harvard University.
President-elect—Arthur D. Black, Northwestern University.
Vice-president—F. V. Simonton, University of California.
Treasurer—William Rice, Tufts College.
Secretary—William J. Gies, Columbia University.

IV. Important Books Recently Received by the Journal of Dental Research[13]

Physical chemistry and biophysics, for students of biology and medicine. By Matthew Steel, Ph.D., Professor of Biological Chemistry, Long Island College Hospital. 1928: pp. 372; 7¼ x 4¼ in.; 38 illustrations; $4.00. John Wiley and Sons, Inc., New York City.

Fundamental principles of a systematic diagnosis of dental anomalies, with an explanation of a new classification based upon gnathostatic methods of investigation. By Paul W. Simon, Head of the Department of Orthodontics, Dental Institute, University of Berlin. *Translated* by B. E. Lischer, D.M.D., F.A.C.D., Non-resident Lecturer on Orthodontics, Dental School, University of Michigan. 1926: pp. 378; 6⅛ x 4 in.; 189 illustrations; $5.00. Stratford Company, Boston, Mass.

The practice of periodontia. By Sidney Sorrin, D.D.S., Chief of Periodontia Clinic, and Samuel C. Miller, D.D.S., Instructor, Periodontia Clinic, College of Dentistry, New York University. 1928: pp. 160; 6 x 3⅝ in.; 122 illustrations; $3.50. MacMillan Company, New York.

The romance of the atom. By Benjamin Harrow, Ph.D., Associate in Biological Chemistry, Columbia University. 1927: pp. 162; 5½ x 3¼ in.; 7 illustrations; $1.50. Boni and Liveright, New York.

The nature of matter, gravitation, and light. By Albert P. Mathews, Ph.D., Professor of Biochemistry, University of Cincinnati. 1927: pp. 222; 6⅝ x 4 in.; 7 illustrations; $7.00. William Wood and Co., New York City.

The religion called behaviorism. By Louis Berman, M.D., Asso-

[13] The sizes of the pages, exclusive of the margins, are given in inches.

ciate in Biological Chemistry, Columbia University. 1927: pp. 153; 5½ x 3⅛ in.; no illustrations; $1.75. Boni and Liveright, New York.

Dental state board questions and answers. By R. MAX GOEPP, M.D., Professor of Principles and Practice of Medicine and of Clinical Medicine, Woman's Medical College of Pennsylvania, Philadelphia. *Fourth edition.* 1928: pp. 463; 7¼ x 4⅜ in.; no illustrations; $4.50. W. B. Saunders Co., Philadelphia and London.

American universities and colleges. By DAVID A. ROBERTSON, B. A., Assistant Director, American Council on Education, Washington, D. C. 1928: pp. 884; 7⅜ x 5⅛ in.; no illustrations; $2.50. Charles Scribner's Sons, New York and London.

An introduction to organic chemistry. By ALEXANDER LOWY, Ph.D., Professor of Organic Chemistry, University of Pittsburgh; and BENJAMIN HARROW, Ph.D., Associate in Biological Chemistry, Columbia University. *Second edition.* 1928: pp. 407; 7 x 4 in.; 22 illustrations; $3.00. John Wiley and Sons, Inc., New York.

A text-book of general bacteriology. By EDWIN O. JORDAN, Ph.D., Professor of Bacteriology, University of Chicago, and Rush Medical College, Chicago, Ill. *Ninth edition.* 1928: pp. 778; 7¼ x 4⅛ in.; 191 illustrations; $6.00. W. B. Saunders Co., Philadelphia and London.

Laboratory manual of physiological chemistry. By MEYER BODANSKY, Associate Professor of Biological Chemistry, and MARION S. FAY, Adjunct Professor of Biological Chemistry, School of Medicine, University of Texas. 1928: pp. 234; 7¼ x 4¼ in.; nine illustrations; $2.00. John Wiley and Sons, Inc., New York City.

Bone as a measure of development; when and how we acquired our teeth. By J. S. FOOTE, A.M., M.D., LL.D., Research Professor in the Dental Department of Creighton University. (*Posthumous.*) Introduction by ARTHUR D. BLACK, Dean of Northwestern University Dental School, Chicago. 1928: pp. 187; 8 x 5 in.; 251 illustrations; $4.00. Scientific Foundation and Research Commission, American Dental Association, Chicago.

Dentition as a measure of maturity. By PSYCHE CATTELL, M.A., Ed.M., Ed.D., Research Associate, Psycho-Educational Clinic, Harvard University, Cambridge, Mass. 1928: pp. 91; 7½ x 4½ in.; 36 figures; $1.00. Harvard University Press, Cambridge, Mass.

Four lectures on radiology and radio-therapy. Delivered (in 1927) under the auspices of the Dental Board of the United Kingdom. 1928: pp. 92; 7¾ x 4⅝ in.; 109 figures. Dental Board of the United Kingdom, 44 Hallam St., Portland Place, London, W. I.

Treatment of the periodontal pocket. By HAROLD KEITH BOX, D.D.S., Ph.D., Research Professor of Periodontology, Faculty of Dentistry, University of Toronto. Foreword by WALLACE SECCOMBE, Dean of the Dental School of the University of Toronto, 1928: pp. 125; 6⅞ x 4½ in.; 120 figures. University of Toronto Press, Toronto, Canada.

Dental histology and embryology. By B. ORBAN, M.D., Professor of Dental Histology and Pathology, Chicago College of Dental Surgery, Dental Department of Loyola University. 1928: pp. 223; 6⅝ x 4 in.; 192 illustrations; $5.00. Rogers Printing Company, Chicago.

Nutrition. By WALTER H. EDDY, Ph.D., Professor of Physiological Chemistry, Teachers College, Columbia University, and Associate Director of the Bureau of Foods and Sanitation of "Good Housekeeping Magazine." 1928: pp. 237; 5¼ x 3¼ in.; no illustrations; $2.50. Williams and Wilkins Company, Baltimore, Md.

Third Report of the Commission on Medical Education. WILLARD C. RAPPLEYE, M.D., Secretary. 1928: pp. 70, 7¼ x 4 in.; no illustrations. Published by the Commission, 215 Whitney Avenue, New Haven, Conn.

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ANNOUNCEMENTS

DANGEROUS TOOTH CLEANING FLUIDS

"Taxi" (Holland Specialty Co., Peoria, Ill.)

and

"Stain Remover" (Ransom and Randolph Co., Toledo, Ohio)

Advertised as non-injurious tooth-cleaning fluids, although rapidly destructive of enamel. See the findings of the Research Council of the New York Academy of Dentistry, and the comment by the manufacturers, in the *Journal of Dental Research*, 1927, vii, pp. 477–500.

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